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MARCH
1953

FACTORY

MANAGEMENT AND MAINTENANCE

PAGE 84

YOUR CHANCE TO CATCH UP WITH

Sonic Energy—A New Tool for Industry

PAGE 96

WITH WORK SIMPLIFICATION

Inspection Lab "Goes Mass Production"

PAGE 102

LARGE OR SMALL, YOUR PLANT CAN USE THIS

Formula for Good Employee Relations

PAGE 113

LUKENS STEEL FOUND OUT, NOW TELLS YOU

How to Find and Control Maintenance Costs

PAGE 136

FOR AUTO BODIES — AND YOUR PRODUCT, TOO

A Better Paint Job by Automatic Spray

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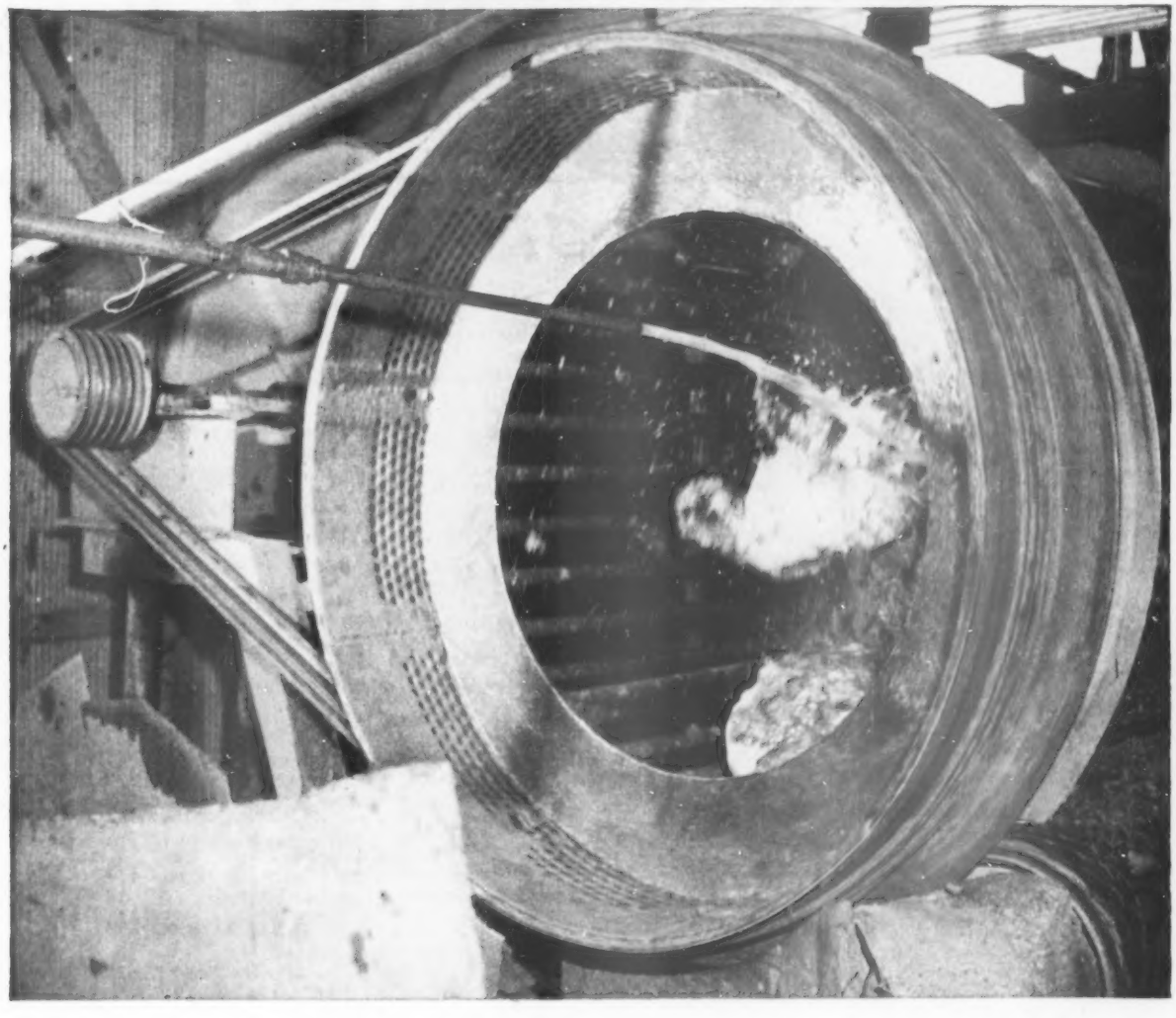

2-foot rocks will some day be glass

A typical example of B.F.Goodrich improvement in rubber

THAT cagelike contraption spins like a top all day long, breaking big rocks into little ones. The rock is a special kind used in making glass. The chunks are sometimes 18 or 24 inches thick.

But just picture the jar every time another load of boulders is dumped in, and the shock to the V belts used to turn the breaker. The jolting action caused ordinary belts to wear out too soon—usually after only two months' work. An entirely new kind of belt was needed, one that could stand shocks and strain.

The owner had heard about the grommet belt developed by B. F. Goodrich to give V belt users more for their money. A *grommet* is a cord loop inside the belt. It is made like a giant twisted cable except that it's endless—no splices or overlaps. The grommets make it a flexible belt but one that stands shocks and heavy loads far better than ordinary belts. No other kind of belt has grommets; no other belt stands so much punishment or lasts so long.

The B. F. Goodrich grommet belts were installed, and last 30% longer than any other belt ever used before.

This performance is typical, not an unusual case at all. It's the result of a policy at B. F. Goodrich—the policy of constant product improvement, of never considering a product "good" enough. If you use rubber belting, hose or other industrial rubber goods, it will pay you to check with your BFG distributor before you buy to see if you, too, can save money because of B. F. Goodrich research. *The B. F. Goodrich Company, Industrial & General Products Division, Akron, Ohio.*

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RUBBER FOR INDUSTRY

FACTORY
MANAGEMENT AND MAINTENANCE

COMPLETE CONTENTS • MARCH 1953 • STARRED ITEMS

special report

Sonic Energy—New Production and Inspection Tool . BY CARROLL W. BOYCE 84 ★

production

With Work Simplification a Lab "Goes Mass Production" BY T. M. WARE 96
Dry-Store Your Welding Rods 99
How Good *Is* Your Production Control? . . . . BY ERNEST J. LAMBERTI 106
Better Paint Job by Automatic Spray . . . . . 136 ★
Fork Truck Operators Help Train Themselves . . . . . BY A. C. ERDMAN and S. A. MARINO 138 ★
Cases in Methods Improvement: Pohl Metal Products Company Better Methods at Bargain Prices 142
Fast Way to Figure Economic Lot Sizes . . . . BY ROBERT GALLOWAY 145
VPI—It Halts Rust in Parts Shipments . . . . BY R. C. LAMBRECHT 148

plant engineering and maintenance

How to Find and Control Your Maintenance Costs . BY HAROLD E. BLISS 113 ★
For other articles dealing with plant engineering problems, see pages 99, 136, 142, 148.

industrial relations

Good Employee Relations in a Small Plant . . . . . 102 ★
In-Plant Training for Better Reading . . . . . BY JAMES S. MASSIE 110 ★
Fine Food at Low Price—and a Profit 135
Filed Under "Beeswax"—*a Toby Quint Episode* . . BY RAY W. SHERMAN 146
Why Labor Leaders Act That Way . . . . . BY W. H. PETERSON 262 ★
Cooperative Education in Britain—*a letter from a reader* 305
See also Tips to Good Human Relations, page 150.

editorial

Are We Doing Enough Small-Scale Research? 83

departments

Looking Ahead in Labor . *after* 80
Looking Ahead in Business *before* 81
Ideas of the Month 100
Operating Shorts 108
Tips to Good Human Relations . 150
New Free Catalogs . . . 154, 242
Joe's Electrical Department . . 156
Maintenance Pointers 160
What's New in Equipment . . 162
Practical Labor Relations . . 226
Plant Engineering Problems . . 250
Plant Operating Problems . . 254
You Mustn't Miss 276
New Materials 310
Books and Booklets 316
Industrial Films 326
Behind the Byline 336

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PAGE

84 **NEATEST TRICK OF THE MONTH** is Carroll Boyce's treatment of this highly technical subject in layman's language. Sonic energy is moving rapidly out of the labs to the inspection benches and the production floor. So you'll want to know what it is and what it might do in your plant.

102 **SOME OBSERVERS MIGHT CALL IT PATERNALISM.** But Gorman-Rupp executives say no, it's **fraternalism**—and there's a big difference. But what's in a name? Main thing is, it's good philosophy and it'll work in any plant, big or small, in any industry.

110 **ANOTHER CURE FOR "BRIEFCASE-ITIS."** Do your top men gear their reading to what they're reading? Micro taught 26 key executives to read faster and better. Didn't take long, either. And didn't upset work and production schedules.

113 **HOW LUKENS STEEL LOPPED** 30% off its maintenance costs by applying modern management methods to its maintenance program.

136 **PRODUCT HAPPENS TO BE AUTO BODIES.** And of course you don't make auto bodies. Don't let that little detail stop you from looking into the possibilities of automatic spray painting.

138 **DOWN WENT FORK TRUCK MAINTENANCE COSTS** after Monsanto Chemical's Plastics Division launched its training program for drivers. Here's the story—plus 32 driver-written rules any plant will be glad to have.

262 **DON'T PASS THIS TIMELY ARTICLE UP** because it's tucked away among the back advertising pages. It gives you the authentic lowdown—valuable information to have on tap any time you're stymied by quixotic union behavior.

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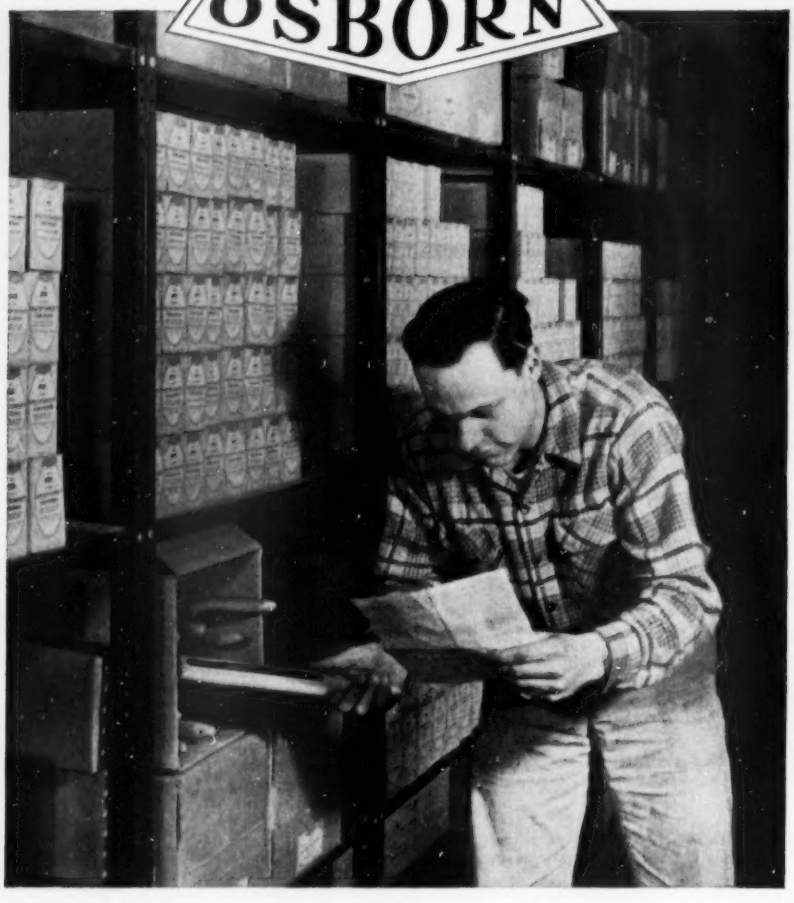

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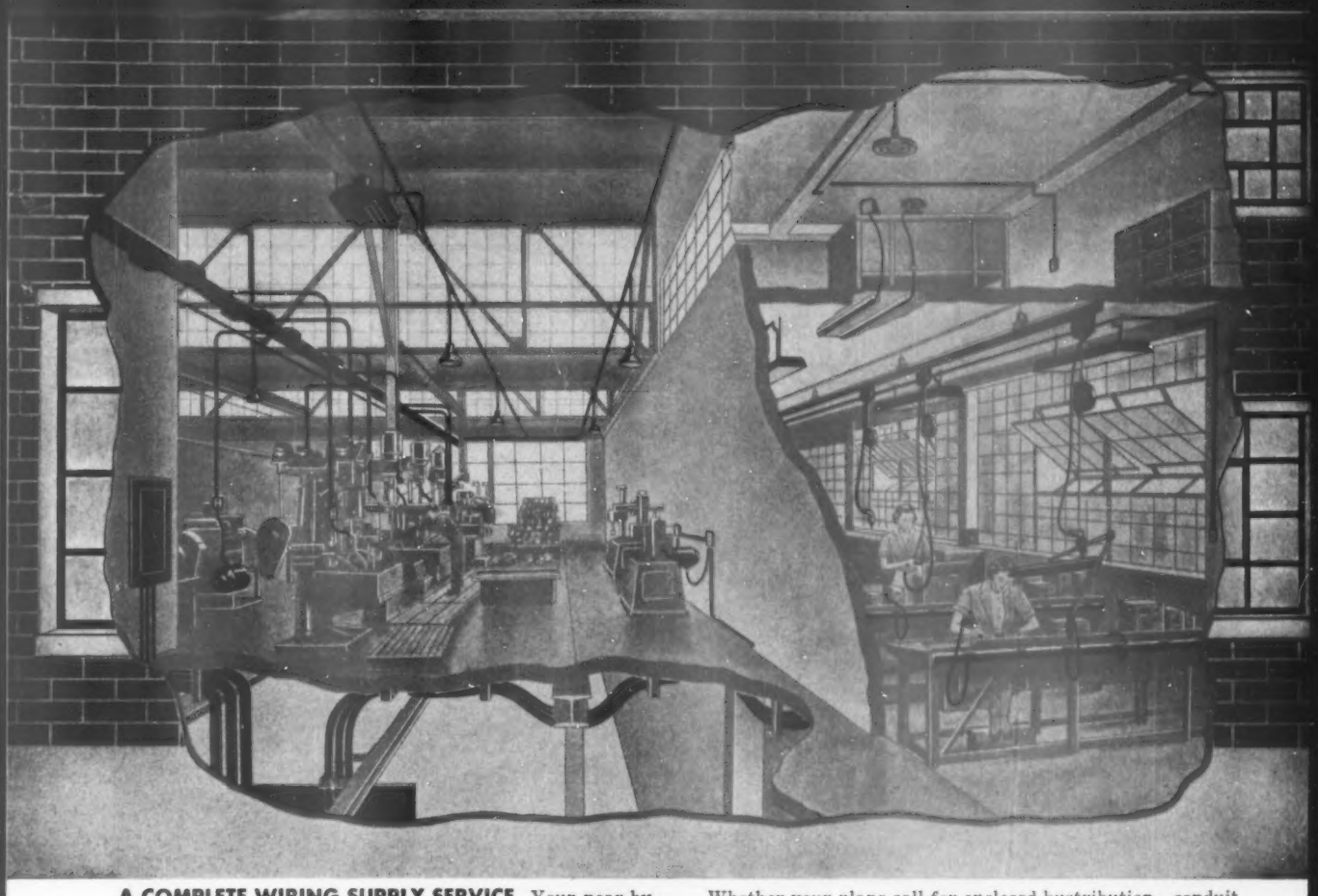

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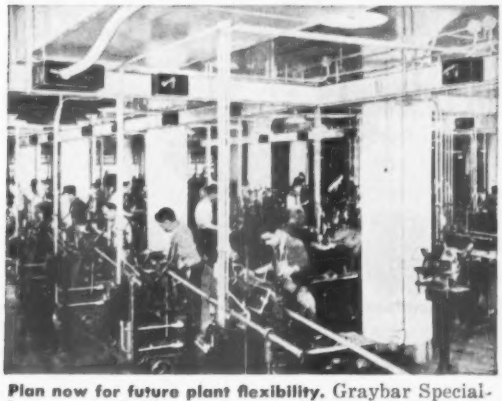

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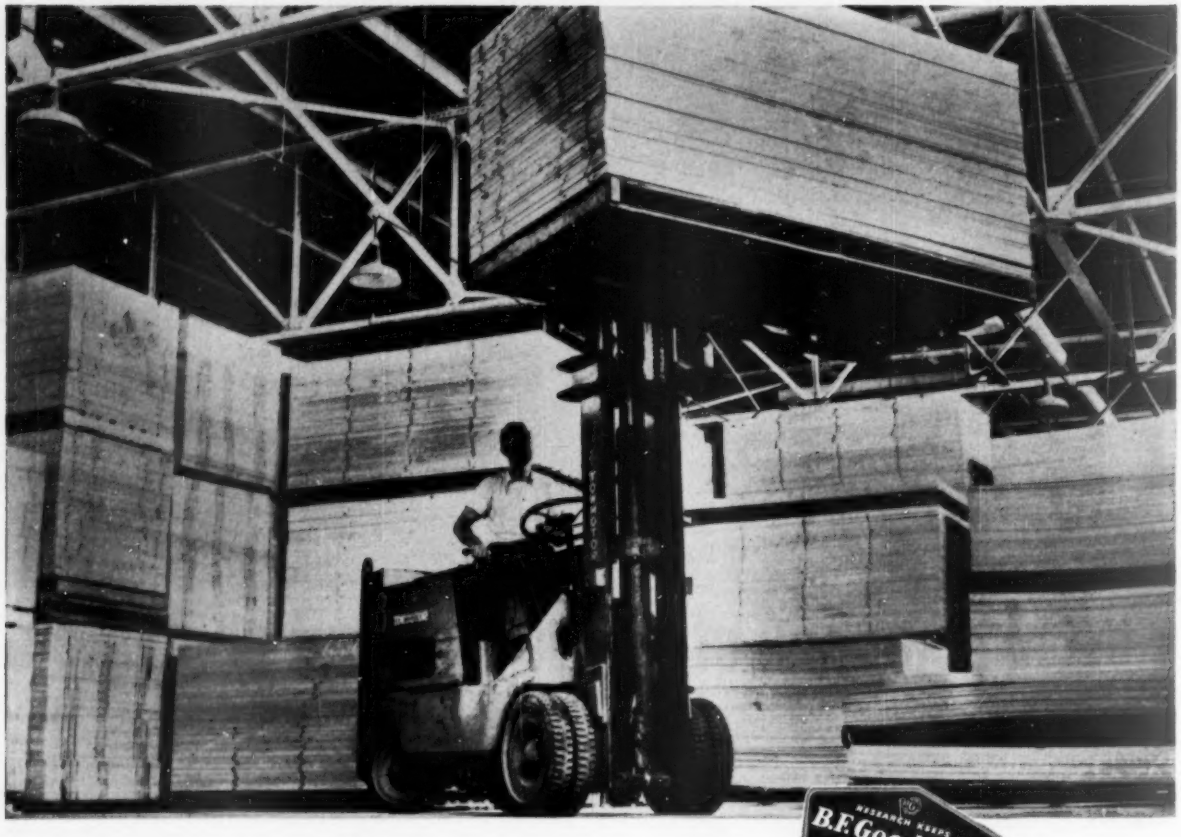

YOU can move more goods more efficiently at lower cost when your materials handling equipment rolls on tires of the right type, size, compound and tread design. But choosing the tires calls for a careful analysis of the kinds of equipment you use; where you operate—indoors or outside; your hauling surfaces; the kind of loads carried and any special conditions such as oily floors.

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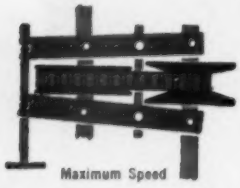

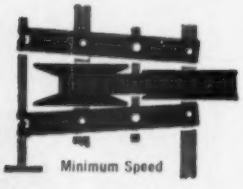

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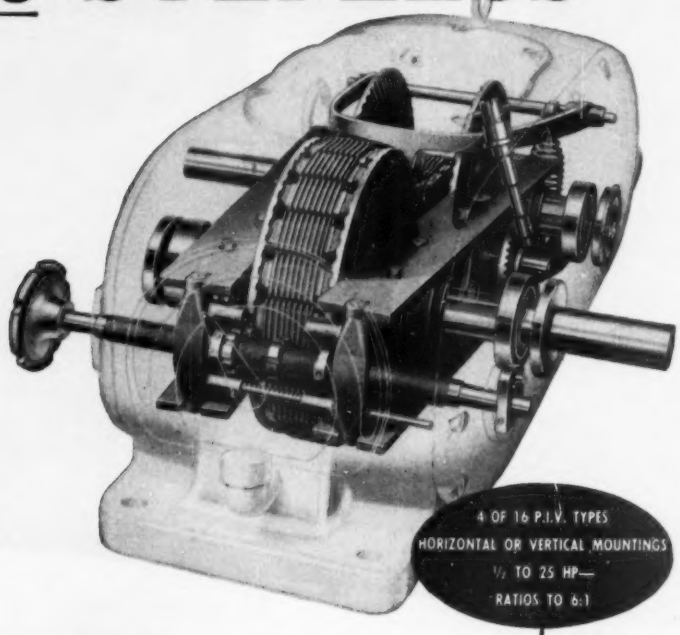

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SELECT ANY SPEED within normal operating range, and you can always be sure Link-Belt's P.I.V. Variable Speed Drive will maintain it accurately under full load conditions.

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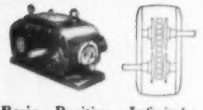
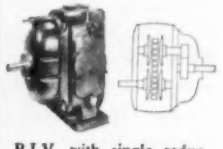
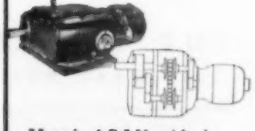


Basic, Positive, Infinitely Variable (P.I.V.) Speed Drive.



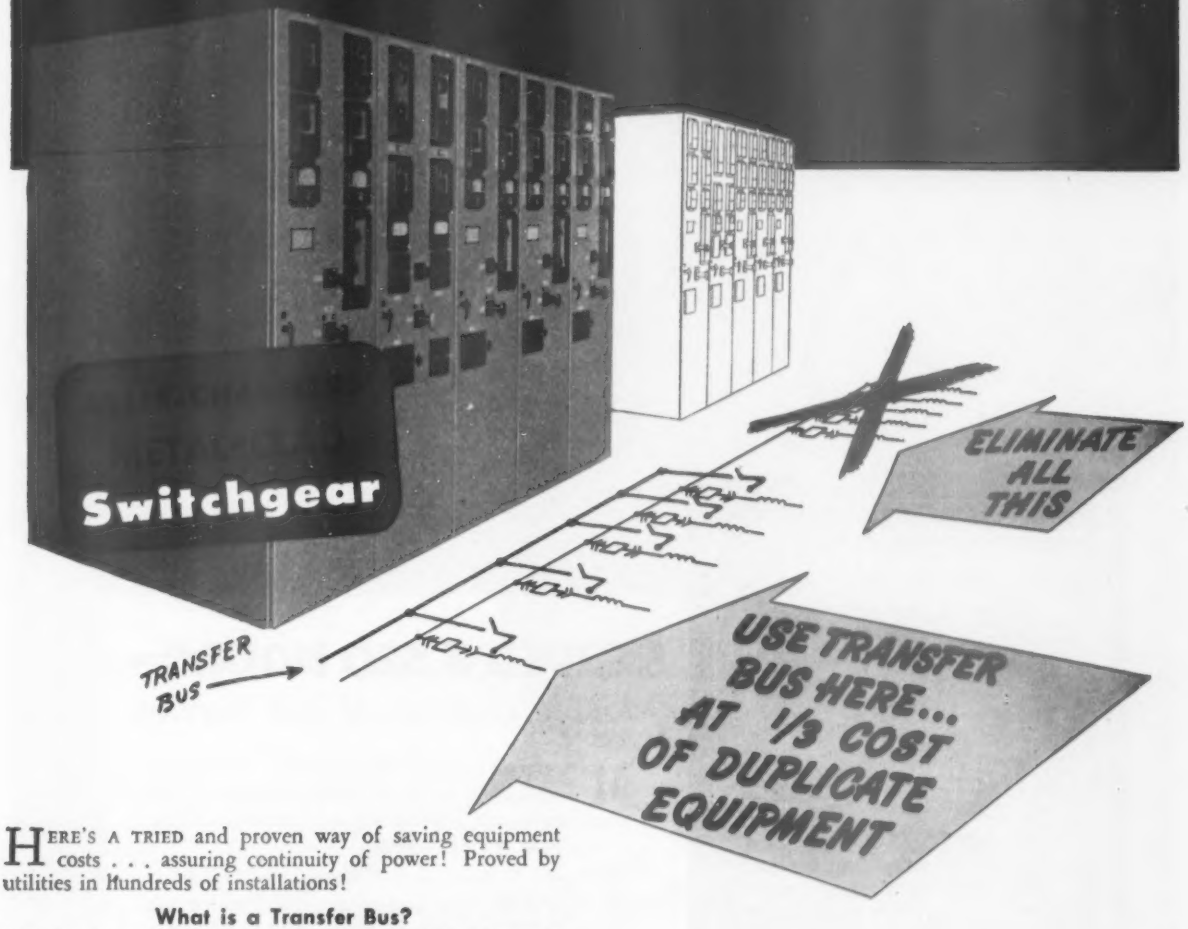
P.I.V. with single reduction input or output helical gears.

Motorized P.I.V. with single reduction input and output helical gears.



Motorized P.I.V. with single reduction input and double reduction output helical gears.

Why Buy Duplicate Switchgear to Assure Power Continuity?



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What is a Transfer Bus?

It's simply a by-pass bus circuit that parallels the main switchgear bus. A switching means is provided so that loads can be transferred to the transfer bus. It's a standby in case anything happens to the main bus. Also, makes it possible to withdraw and maintain circuit breakers, or inspect main bus without power stoppage.

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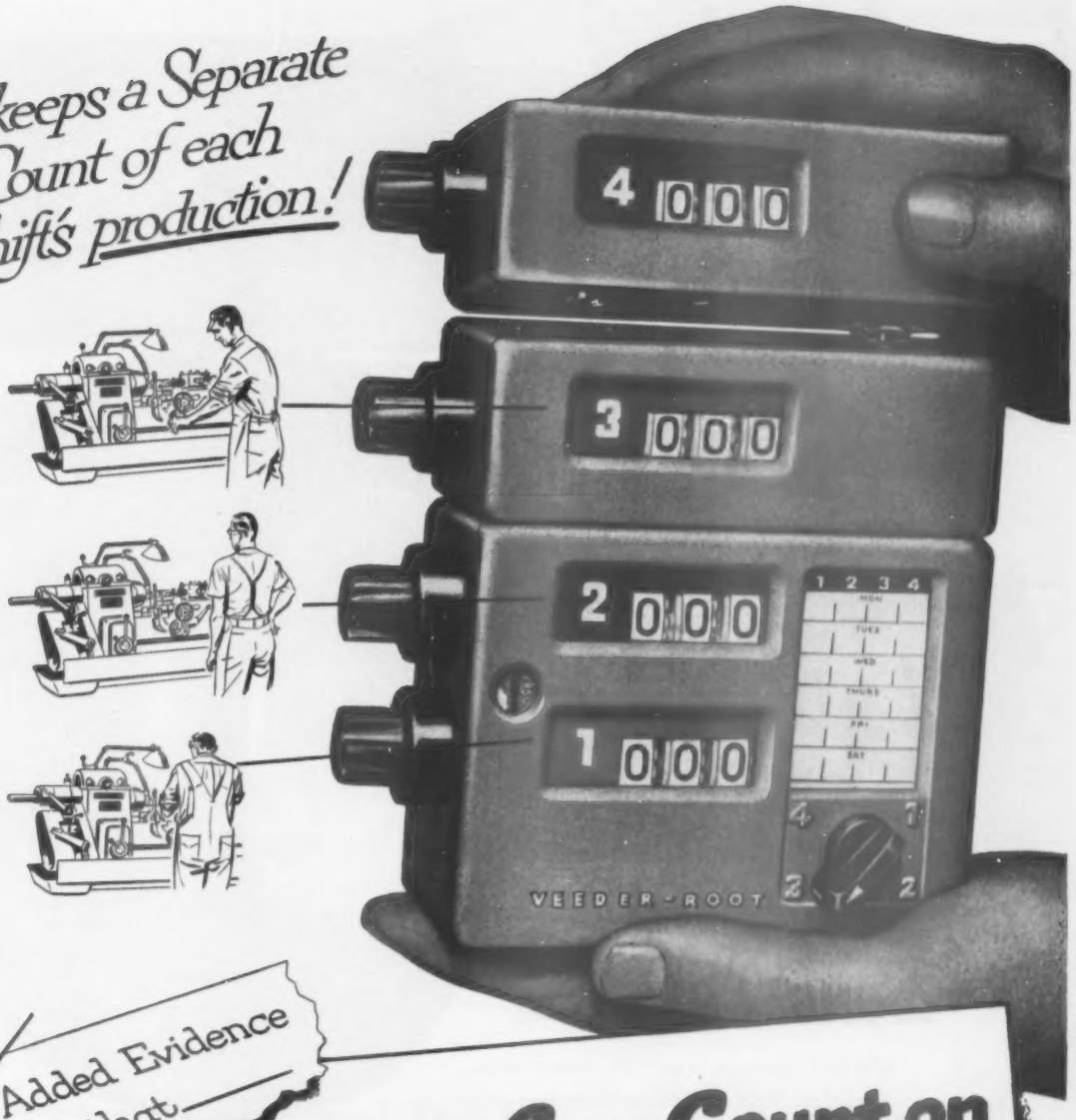

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MOST TRUCKS COME EQUIPPED

WITH *Mono-Cushions*

● Why? Because most lift truck manufacturers realize that **Monarch Mono-Cushions** help users, like yourself, get more operating efficiency from their trucks. **Mono-Cushions** soak up fatiguing floor vibration . . . reduce peeling and skidding on take-offs and stops. Your drivers discover your trucks handle easier, respond quicker on **Mono-Cushions.** Remember! Most lift truck manufacturers select **Monarch Mono-Cushions** for the same reason you pick their trucks . . . dependability!

CALL YOUR TRUCK DISTRIBUTOR FOR *Tire Replacements...*

Follow the lead of your truck manufacturer and tire serviceman. Re-equip them with ***Monarchs*** *. . . the king of the truck tires. Monarchs are easier on drivers, trucks and floors. Don't waste your lift truck's efficiency. Have your truck serviceman put Monarchs back on them again!*

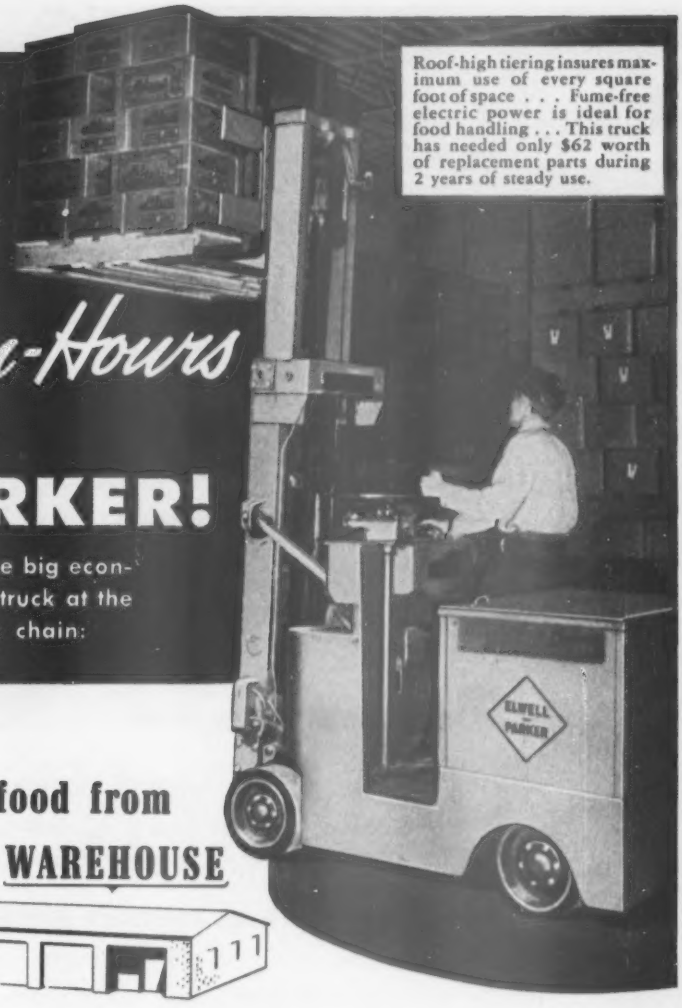
THE MONARCH RUBBER COMPANY

550 LINCOLN PARK • HARTVILLE, OHIO

SPECIALISTS IN INDUSTRIAL SOLID TIRES AND MOLDED MECHANICAL RUBBER GOODS

60% Saving in Man-Hours made by this ELWELL-PARKER!

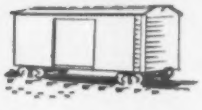
Here is a typical example of the big economies made by this E-P fork truck at the warehouse of a large grocery chain:

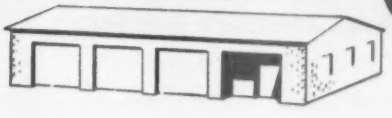


Roof-high tiering insures maximum use of every square foot of space . . . Fume-free electric power is ideal for food handling . . . This truck has needed only $62 worth of replacement parts during 2 years of steady use.

THE JOB...

Moving 2000 Cases of food from BOXCAR to storage in WAREHOUSE





PREVIOUSLY DONE BY...

8 MEN using 4-wheel TRUCKS

TOTAL MAN-HOURS REQUIRED 20

NOW DONE BY...

E-P TRUCK and 2 MEN

TOTAL MAN-HOURS REQUIRED 8

SAVINGS...12 Man-Hours or 60%

Elwell-Parker trucks have developed notable *savings* in over 300 branches of industry during the past 44 years. To help you profit by this *unexcelled* materials handling experience, your near-by man is at your service. The Elwell-Parker Electric Co., 4022 St. Clair Avenue, Cleveland 3, Ohio.

NEW, ILLUSTRATED CATALOG describes *all* types of E-P trucks. Write for this catalog and name your product.

"Our railroad bridge is an

EYE OPENER

for anybody with an assembly problem"

"Whether you're assembling toasters or bridges," Ken went on, *"it pays to set your sights on fasteners."*

"Fasteners?" asked Jack.

"Right!" affirmed Ken. *"We've saved plenty by taking the RB&W man's advice to switch from rivets to high strength RB&W bolts in assembling high stressed structural joints.*

"These bolts stay tight and that saves us maintenance. They assemble faster, and that saves us labor and construction time."

There's a cost-cutting lesson for you in this story, whatever your industry.* So look to your fasteners for an often overlooked opportunity to reduce costs, and strengthen your competitive position. New inventions, like RB&W's SPIN-LOCK Screw, may prove more efficient than the fasteners you're now using.** Or you may save by the stepped-up production you get from using the finest fasteners... RB&W bolts, nuts, rivets and screws of uniform accuracy, dependability and physical properties.

Let RB&W help you make the most efficient use of fasteners on your assembly line. Address RB&W at Port Chester.

RB&W—The Complete Quality Line. Plants at: Port Chester, N.Y., Coraopolis, Pa., Rock Falls, Ill., Los Angeles, Calif. Additional sales offices: Philadelphia, Pittsburgh, Detroit, Chicago, Dallas, San Francisco. Sales agents: Portland, Seattle. Distributors from coast to coast.

RUSSELL, BURDSALL & WARD BOLT & NUT COMPANY

RB&W

107 YEARS MAKING STRONG THE THINGS THAT MAKE AMERICA STRONG

*If you're interested in construction, write RB&W at Port Chester for the free article, "No More Riveting."

**New SPIN-LOCK Catalog is in the Product Design File. Write for extra copies.

NOW

A NEW LINE OF Automatic Skylift Trucks

AT NEW LOW PRICES

New "Standard" Automatics bring famous, money-saving Skylift quality within price reach of every business

COMPARE THESE FEATURES

Capacities 1000 to 4000 pounds

FEATURE	BENEFIT	TRUCK A	TRUCK B	TRUCK C	AUTOMATIC
Only Automatic Skylifts have Silicone insulation	Max. protection against motor damage from overheating	—	—	—	✓
Ball bearing mounted carriage and upright rollers	Friction-free lift, less wear —minimum current draw	✓	—	—	✓
Full magnetic control with plug-proof protection	Safety—lowest maintenance	✓	✓	—	✓
Spur and Hypoid gear drive fully enclosed in oil bath	Maximum efficiency under all load conditions	✓	—	—	✓
Patented duelift rams with leakage return	Exclusive! Protects ram plunger from dirt, damage	—	—	—	✓
Highest lift speed of any electric truck	Does more work—faster	—	—	—	✓
Heavy section rolled manganese alloy steel uprights	Better wearing quality, proper flange strength	✓	—	—	✓
Hydraulic Safety Fuse	Locks load in position if line ruptures	—	—	—	✓
Greatest accessibility for maintenance	Minimum down time, lowest maintenance costs	—	—	—	✓

Now, for the first time, Automatic makes available to industrial truck users a new line of battery-operated Skylift fork trucks *at new low prices*...with MORE MONEY-SAVING FEATURES than any other electric truck.

Built for Trouble-Free, Heavy-Duty Service

These rugged, new "Standard" Skylifts... built to give long, repair-free service, maximum maneuverability and smooth, fast, dependable operation...are equalled by no other truck for quality, price and performance.

Before you buy any lift truck, get the complete money-saving facts on the amazing materials handling savings these new Automatic "Standard" Skylifts will bring to *your business!* **2000 lb. model only $3575.00* F.O.B. Chicago**

PRICE IN U.S.A.

*Monolift Model

GET ALL THE FACTS—MAIL THIS COUPON TODAY

Automatic®

LARGEST EXCLUSIVE BUILDER OF ELECTRIC INDUSTRIAL TRUCKS

Automatic · 39 West 87th Street, Dept. C-3 Chicago 20, Illinois

Without obligation, please send me full details and prices on your new line of low price "Standard" Skylift trucks.

Company Name.....

By.....*Title*.....

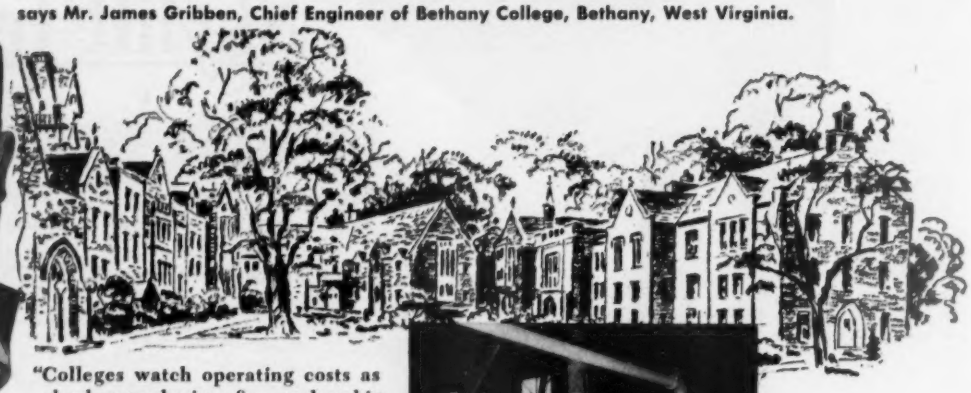
Address.....

City.....*Zone*.....*State*.....

"We 'educated' our College Heating Plant...

with a modern coal installation we saved more than a third of our fuel bill,"

says Mr. James Gribben, Chief Engineer of Bethany College, Bethany, West Virginia.



"Colleges watch operating costs as closely as any business firm—and one big item for our college is the heating bill. That's exactly why Bethany went to the expense of putting in new coal heating equipment! Our old system supplied heat for sixteen buildings—to the tune of 2,600 tons of coal a year. Our new installation, with its automatic stoker, does the same job using only 1,650 tons. That's a fuel saving of 38.9%! Our eyes certainly have been opened to the efficiency and economy of *bituminous* coal—especially when it's burned with modern equipment."

Here's Bethany's new boiler room, showing the pipe of the automatic stoker. **THIS MODERN EQUIPMENT WILL PAY FOR ITSELF, THROUGH FUEL SAVINGS ALONE, IN LESS THAN TWO YEARS!**

Modern combustion installations can add anywhere from 10% to 40% to the energy obtained from the same amount of coal in years gone by. Great advances have been made in coal- and ash-handling equipment, too—cutting labor costs—making coal as clean and convenient to use as any fuel.

If you're planning to modernize your present installation—or thinking of building a new plant, call in a competent consulting engineer. He'll show you how a modern coal system designed to meet your specific needs can save you money and serve you better!

And don't forget—you'll always be able to get the coal you need. America's coal industry is the most efficient in the world. America's coal reserves are ample for centuries to come. Right now and for the future, too, coal users can be assured of a dependable fuel supply at reasonable prices.

BITUMINOUS COAL INSTITUTE
A Department of National Coal Association
Washington, D. C.

If you're running your own steam plant—for heat or for power—you just can't afford to ignore these facts!

COAL in most places is today's most economical fuel.

COAL resources in America are adequate for all needs—for hundreds of years to come.

COAL production in the U.S.A. is highly mechanized and by far the most efficient in the world.

COAL prices will therefore remain the most stable of all fuels.

COAL is the safest fuel to store and use.

COAL is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

FOR HIGH EFFICIENCY *FOR LOW COST*

YOU CAN COUNT ON COAL!

1878 75 1953
YEARS OF ELECTRICAL PROGRESS

These bearings last longer than life . . . grease life

G-E TRI/CLAD MOTORS LAST LONGER

REG. U.S. PAT. OFF.

ALL GREASE LIFE IS LIMITED. The best known greases dry out in time. This may be six months, seven years, or longer, depending on motor application.

SOME MOTORS ARE USELESS WHEN GREASE DRIES OUT. They can't be regreased, you lose production time . . . because your maintenance man is "sealed out."

BUT GREASE LIFE NEED NOT LIMIT MOTOR LIFE. Tri-Clad motors give long life without relubrication, plus provision for adding new grease when necessary.

ADDED GREASE IS USEFUL GREASE. Relubrication puts fresh grease in storage in bearing housing . . . as motor operates, grease oils migrate to bearing as needed.

TRI-CLAD MOTOR BEARING IS EASIEST TO REGREASE. Do it on the job, with motor running . . . no dismantling . . . no trip to a service shop.

TRI-CLAD MOTOR BEARING IS BETTER PROTECTED. Completely enclosed housing has *longer seals* to keep dirt out, *larger grease supply*, and *scientific design* for continual grease migration.

THIS PRACTICAL BEARING DESIGN is one more reason why G-E Tri-Clad motors give better service . . . added life. Order through your nearby G-E Apparatus Sales Office or authorized G-E agent or distributor. General Electric Company, Schenectady 5, N. Y.

752-18

You can put your confidence in—

GENERAL ELECTRIC

TWO TRUCK BATTERIES ARE CHARGED AT SAME TIME USING G-E SEQUENCE CHARGE CONTROL AT BEECH-NUT PACKING COMPANY.

G-E Charger with Sequence Charge Control cuts costs; charges two batteries at once

MORE WORKING TIME for fork trucks like this one moving Beech-Nut baby food, when truck batteries are charged two at a time in working area.

"For our driver-ride lift trucks, I have proved that there is no finer equipment than G-E Metallic Rectifier Chargers," reports L. M. Spraker, Materials Handling Engineer, Beech-Nut Packing Co., Canajoharie, N. Y., "and I double the capacity of G-E Chargers with G-E Sequence Charge Control."

SAVES TIME, SPACE. You can charge two batteries at a time, and save valuable floor space as well, with G-E Sequence Charge Control. A competent electrician can attach it to any G-E Metallic Rectifier Truck Charger.

EASY TO INSTALL. Your trucks' power-consuming time is more productive when you install G-E Chargers right in your working areas. Installation is simple. No special foundations are needed.

LONG LASTING. Safety features prevent damage to charger and battery in case of power failure. G-E battery chargers last for years with virtually no maintenance.

FOR INFORMATION, see your nearest industrial truck representative, or write Section 463-8, General Electric Co., Schenectady 5, New York.

You can put your confidence in—

GENERAL ELECTRIC

When Honest Work Comes High

Good, honest work like this comes mighty high when it's going into excessive piping repairs and replacements. And how do you control such high costs?

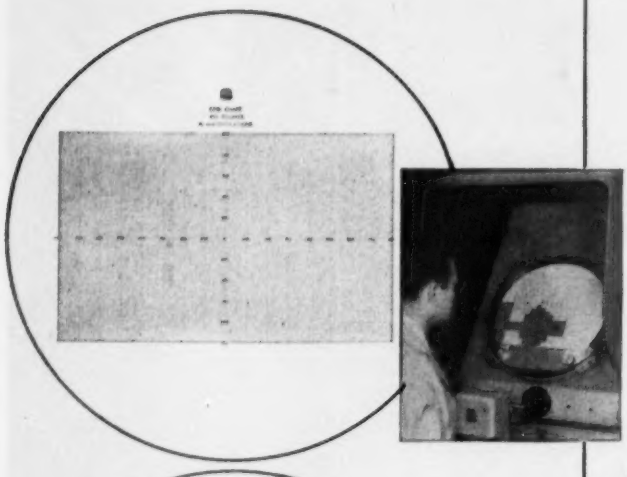
Thrifty buying with a careful eye on the quality of piping materials can help a lot. At today's maintenance rates, better quality was never a sounder investment. The more piping you have, the more you'll see how true this is.

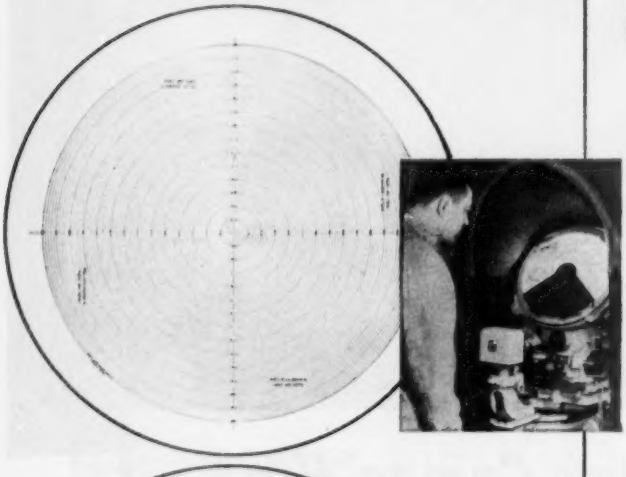
Better quality equipment doesn't cost a penny more. Not when you know the savings it makes in longer life and fewer repairs. There's real economy in valves and fittings that do this. That's why Crane Quality makes Crane equipment the choice of the thrifty buyer.

Crane Co., *General Offices:* 836 S. Michigan Ave., Chicago 5, Ill. *Branches and Wholesalers Serving All Industrial Areas.*

CRANE

VALVES • FITTINGS • PIPE • PLUMBING • HEATING





YOU CAN CHECK IT FASTER

with Precision Made Jones & Lamson *Comparator Charts*

With these charts many ***Difficult Inspection Operations Become Routine Jobs.***

They are ***Invaluable Accessories*** that ***Add*** to the ***Economy*** and ***Versatility*** of the ***Comparator.***

Top Quality Materials, Expertly Processed, assure ***Uniform Density*** of ***Lines*** and provide ***Maximum Contrast Between Outline And Image.***

Made To Precision Standards Of Accuracy established during more than ***30 Years Of Specialized Optical Experience.***

Write to Dept. 710 for your copy of our Chart Catalog No. 471.

JONES & LAMSON

Machine Tool Craftsmen Since 1835

JONES & LAMSON MACHINE CO., 505 Clinton St., Dept. 710, Springfield, Vt., U.S.A.

OPTICAL COMPARATOR DIV.

A Graphic Illustration of Your Maintenance Painting Costs

Keep this picture clearly in your mind. On practically all maintenance painting jobs, the paint represents only 20 per cent of the cost; labor, *80 per cent.* And the paint you specify has a tremendous bearing on what you save or lose on labor.

That is why so many prominent industrial, commercial and institutional buildings have specified Barreled Sunlight paint for so long. Some as long as fifty years. They're willing to pay a few more pennies per gallon for Barreled Sunlight to get that extra quality which means extra savings in both paint and labor. They know that Barreled Sunlight takes more thinner . . . cuts material costs. Yes, and of even greater importance, they know that Barreled Sunlight covers better, goes on faster and lasts longer . . . requires less labor per job *and less frequent jobs.*

If you find this hard to believe, let one of our representatives explain a fair, simple on-the-wall test which will *prove* how much you can save on painting by buying the best in paint . . . Barreled Sunlight paint. Write and he'll promptly call.

SEND FOR THIS NEW CATALOG NOW . . . For full information on all Barreled Sunlight Maintenance Finishes . . . as well as Barreled Sunlight's new and advanced "Engineered Color" Plan . . . write today on your company letterhead for this new Barreled Sunlight Catalog. No charge. No obligation.

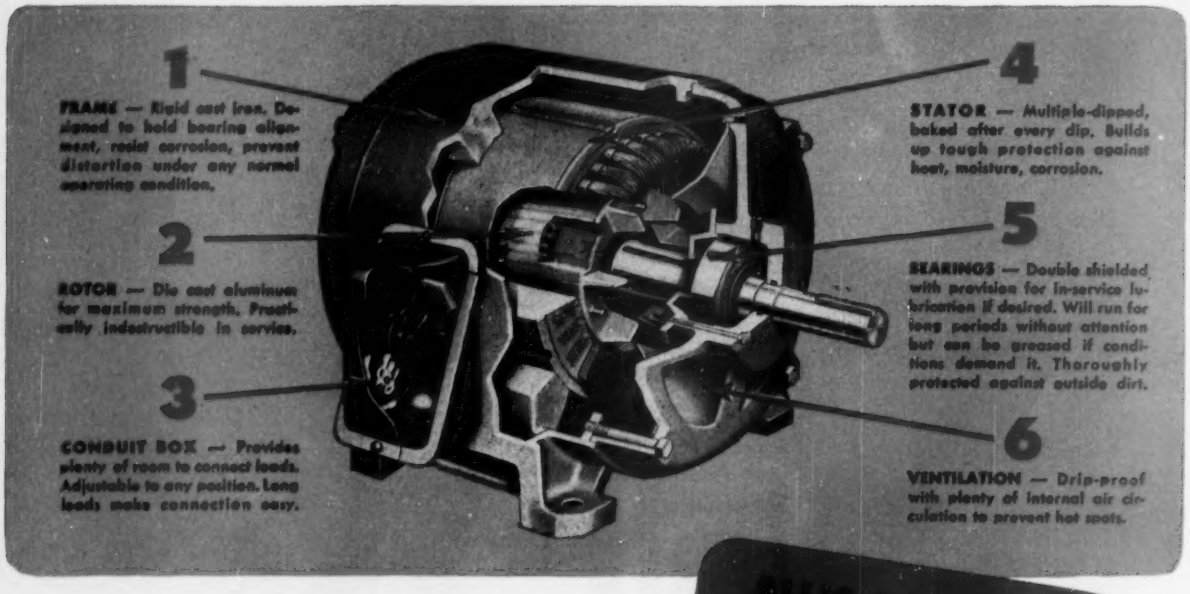
BARRELED SUNLIGHT PAINT COMPANY
2-C Dudley St., Providence, R. I.

Barreled Sunlight® Paints

In whitest white or clean, clear, wanted colors, there's a Barreled Sunlight Paint for every job

For over half a century those who know the best in paints . . . for all types of buildings . . . have strongly insisted on famous Barreled Sunlight

Look for These 6 Signs of Good Motor Design


1
FRAME — Rigid cast iron. Designed to hold bearing alignment, resist corrosion, prevent distortion under any normal operating condition.
2
ROTOR — Die cast aluminum for maximum strength. Practically indestructible in service.
3
CONDUIT BOX — Provides plenty of room to connect leads. Adjustable to any position. Long leads make connection easy.
4
STATOR — Multiple-dipped, baked after every dip. Builds up tough protection against heat, moisture, corrosion.
5
BEARINGS — Double shielded with provision for in-service lubrication if desired. Will run for long periods without attention but can be greased if conditions demand it. Thoroughly protected against outside dirt.
6
VENTILATION — Drip-proof with plenty of internal air circulation to prevent hot spots.

Get Allis-Chalmers Motors for these Extra Values!

ALLIS-CHALMERS **MOTORS**

Certified Service — Nearly 100 Allis-Chalmers Certified Service Shops provide factory-approved parts and service on your Allis-Chalmers motors. Screened for modern equipment, adequate experience and business integrity, these independently owned service shops will provide you with prompt, economical repair and maintenance.

Complete Drives from One Source — Allis-Chalmers can supply your complete drive — motor, control and *Texrope* V-belt drive — from one convenient, reliable source.

Application Engineering — Your Allis-Chalmers District Office representative or Authorized Dealer will be glad to help you select exactly the right motors for your needs. For additional information, write Allis-Chalmers, Milwaukee 1, Wisconsin, for Bulletin 51B6052. A-3954

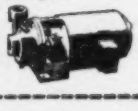
Texrope is an Allis-Chalmers trademark.

Sold . . .
Applied . . .
Serviced . . .

by Allis-Chalmers Authorized Distributors, Certified Service Shops and Sales Offices throughout the country.

CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

TEXROPE V-belts in all sizes and sections, standard and *Vari-Pitch* sheaves, speed changers.



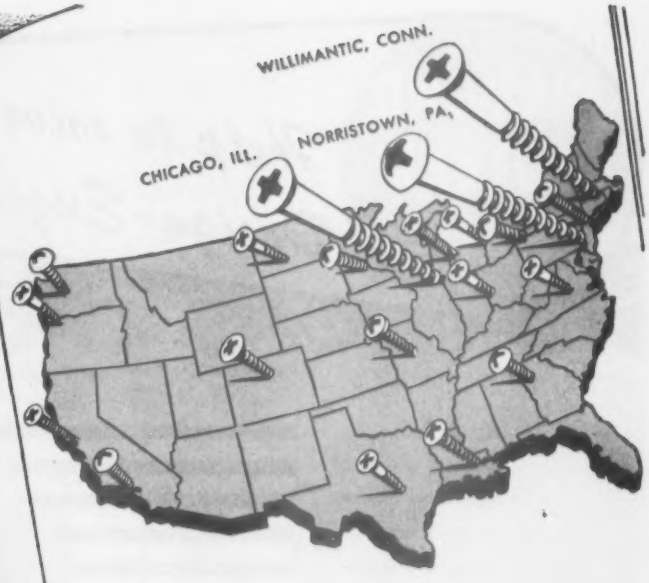
PUMPS — Integral types from ¾ in. to 72 in. discharge and up.

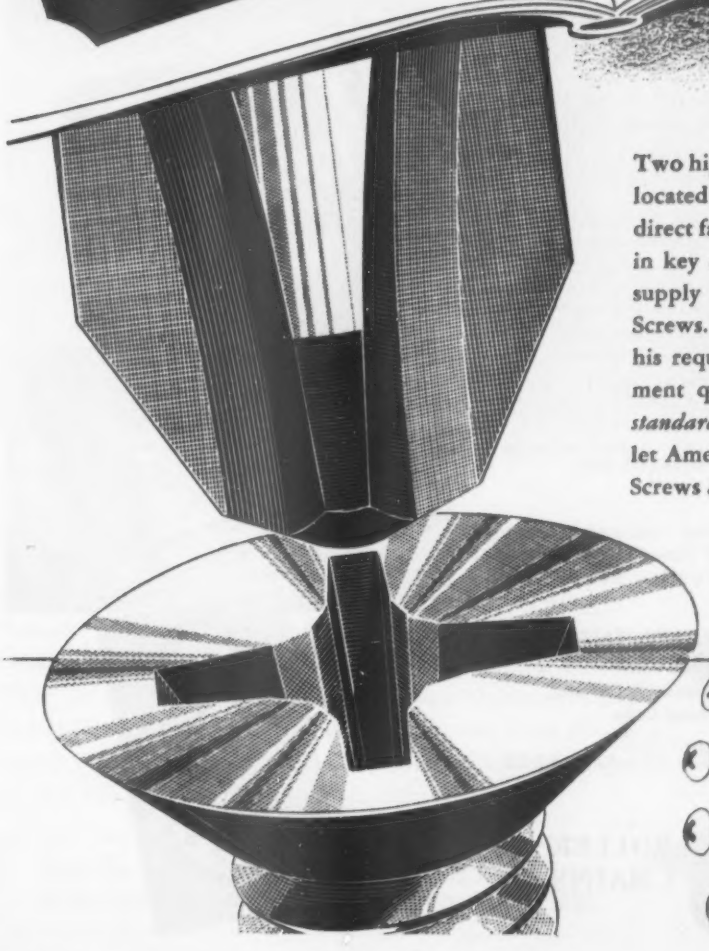
ALLIS-CHALMERS

THE AMERICAN STORY

CHAPTER 6:

"LOGISTICS" (or How to Supply You Most Efficiently)





Two high-production plants and a conveniently located mid-continent warehouse . . . plus direct factory representatives and top distributors in key cities from coast to coast . . . this is the supply service set-up for American Phillips Screws. So every user can be sure that he can get his requirements promptly . . . with every shipment quality-controlled to *American's stubborn standards.* If you want to cut your fastening costs, let American show you how American Phillips Screws *always cost less* in the long run. Write:

AMERICAN SCREW COMPANY

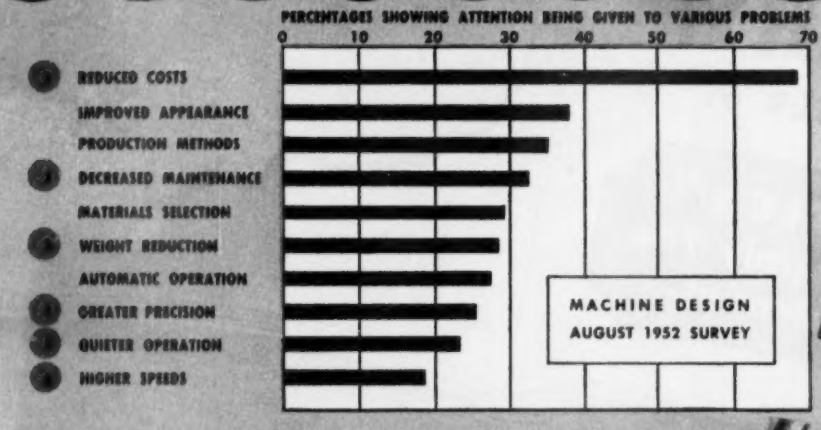
PHILLIPS HEADquarters

WILLIMANTIC, CONNECTICUT

Main Office & Plant
Willimantic, Conn.
Office & Plant, Norristown, Pa.
Office & Warehouse, Chicago, Ill.

DIAMOND ROLLER CHAINS

Help to solve these Design-Engineer Problems



Shot-Peening Since 1944

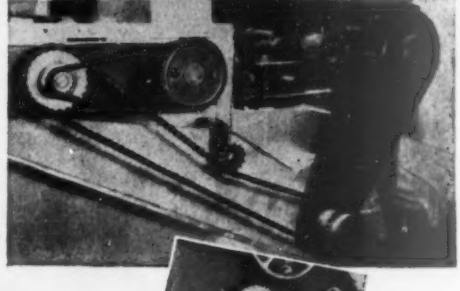
Diamond Chain has long recognized that certain types of internal stressing of chain parts would increase fatigue resistance. To this end, link plates have been specially processed and chain rollers and other parts have been shot-peened since 1944.

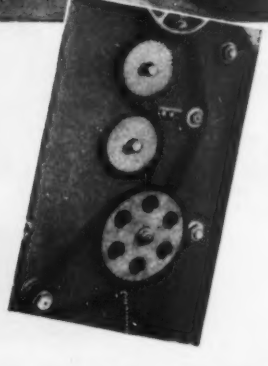
Another Diamond Advantage

Fully equipped and well staffed chemical and physical testing laboratories have made it possible to control raw material specification, their treatment and processing.

In the case of six of the problems designated by the *Machine Design* survey, Diamond Roller Chains provide definite help:

1. **REDUCED COSTS**—Ease of installation and simplification of design reduce costs. Center distances can be short or long. And absence of separating forces reduce size and cost of bearings.
2. **DECREASED MAINTENANCE**—Longer life; load is distributed over many teeth. Ease of adjustment or replacement minimizes maintenance.
3. **WEIGHT REDUCTION**—Diamond Roller Chains are light compared to tensile strength and power transferred. Sprockets mesh with either side of chain eliminating heavy gear trains for multiple shaft operation.
4. **GREATER PRECISION**—No slip or stretch, with definite speed ratio maintained. Diamond Chains are pre-loaded before shipment.
5. **QUIETER OPERATION**—The precision manufacture of all parts, the free roll of bushings and rollers result in smooth, quiet operation at all speeds.
6. **HIGHER SPEEDS**—Diamond Roller Chains are so light in relation to power transmission capacities and tensile strengths that stresses due to centrifugal force are negligible until linear speeds approach 30,000 f.p.m.





Product design engineers will find the experienced Diamond engineering staff ready at all times to make practical recommendations. Our Catalog 709 is a helpful guide to have available for ready reference.

DIAMOND CHAIN COMPANY, INC.

Where High Quality is Tradition

Dept. 449, 402 Kentucky Ave., Indianapolis 7, Indiana

Offices and Distributors in All Principal Cities

Refer to the classified section of your local telephone directory under the heading CHAINS or CHAINS-ROLLER

Loading a 1,200-pound cargo of castings onto an American Airlines freighter.

TOWMOTORS IN ACTION IN U S INDUSTRY

Right on schedule . . .

However tight the timing and whatever the type of load . . . Towmotor measures up to stiffest materials handling requirements, while bringing man-hour costs 'way down in the bargain. Write for your copy of "Man-Hour Thieves," Towmotor's new handbook for lowering plant operating costs, and name of your nearest Towmotor Representative. Towmotor Corporation, Div. 503, 1226 E. 152nd St., Cleveland 10, Ohio.

Make the Towmotor Exhibit your first stop at the Fifth National Materials Handling Exposition starting May 18, 1953.

TOWMOTOR
THE ONE-MAN-GANG

FORK LIFT TRUCKS AND TRACTORS

Since 1919

RECEIVING • PROCESSING • STORAGE • DISTRIBUTION

"We tried FUSETRON dual-element FUSES on our crane motor circuits . . . they reduced fuse blows from four or five a day to only three in seven months"

Chas. A. Gardner, *Chief Electrician,*
Nicholson Terminal & Dock
Ecorse, Detroit, Michigan

PROBLEM

"We have many overhead cranes that operate on 24 hour schedules. The severe service to which these cranes are put when loading and unloading ships throws a tough load on the motors. This was causing us a lot of grief due to fuses blowing 4 or 5 times a day. Each blow caused a shutdown that stopped work and made men idle.

SOLUTION

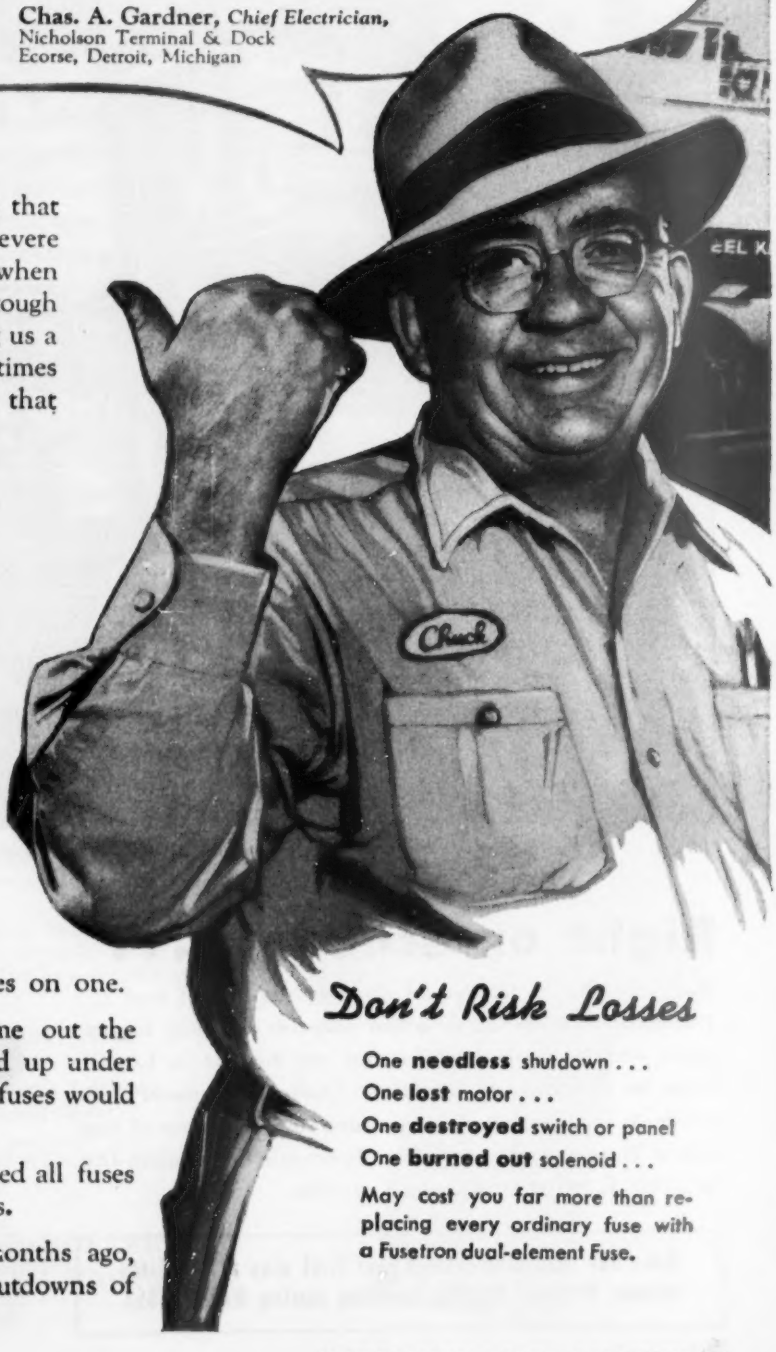
"In testing Fusetron fuses to see if they would help us, we selected a certain crane and inserted Fusetron fuses in that circuit for one 8 hour shift. At the end of the shift we would replace the Fusetron fuses with the ordinary renewable fuses we had formerly used. Then we compared the down time of the crane due to fuse blows.

"To be sure the fuse blows weren't due to the operator, we changed around and would run the Fusetron fuses on two shifts and the old fuses on one.

"The results, however, always came out the same. The Fusetron fuses would stand up under the hard service — and the ordinary fuses would not.

"As a result of these tests we changed all fuses on our crane circuits to Fusetron fuses.

"That was last October, seven months ago, and to date we have had only 3 shutdowns of our cranes due to fuses blowing."



Don't Risk Losses

One **needless** shutdown . . .
One **lost** motor . . .
One **destroyed** switch or panel
One **burned out** solenoid . . .

May cost you far more than replacing every ordinary fuse with a Fusetron dual-element Fuse.

FUSETRON dual-element FUSES Protect Production *10* Ways

1 *Protect against short-circuits.

2 Protect against needless blows caused by harmless overloads.

3 Protect against needless blows caused by excessive heating—lesser resistance results in cooler operation.

4 Provide thermal protection—for panels and switches against damage from heating due to poor contact.

5 Protect motors against burnout from overloading.

6 Protect motors against burnout due to single phasing.

7 Give DOUBLE burnout protection to large motors — without extra cost.

8 Make protection of small motors simple and inexpensive.

9 Protect against waste of space and money — permit use of proper size switches and panels.

10 Protect coils, transformers and solenoids against burnout.

*Fusetron Fuses have high interrupting capacity as shown by tests of the Electrical Testing Laboratories of New York.

HERE'S WHY...

A fuse link combined with a thermal cutout — the result, a fuse with tremendous time-lag and much less electrical resistance.

They have the same degree of Underwriters Laboratories approval for both motor-running and circuit protection as the most expensive devices made.

Made to same dimensions as ordinary fuses, FUSETRON FUSES fit all standard fuse holders.

Obtainable in all sizes from 1/10 to 600 ampere, both 250 and 600 volt types. Also in plug types for 125 volt circuits.

Their cost is surprisingly low.

FUSETRON is a trade mark of the Bussmann Mfg. Co.

Bussmann Mfg. Co., University at Jefferson,
St. Louis 7, Mo. (Division of McGraw Electric Co.)

Please send me complete facts about FUSETRON dual-element Fuses.

Name_____

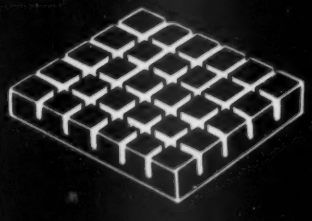
Title_____

Company _____

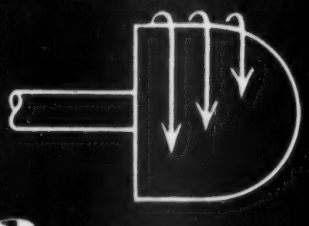
Address _____

City & Zone_____ State_____ 353

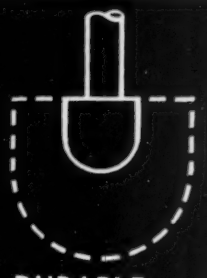
1. UNIFORM



2. SAFE



3. ACCURATE



4. DURABLE

...use.

You get...

UNIFORM

SAFE

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PRODUCTION

1. Made from solid blocks of perfectly mixed materials.
Result: Complete elimination of "hard and soft" spots.

2. Deep-knurled, high strength alloy steel spindles, and special adhesive.
Result: Abrasive heads stay on spindles.

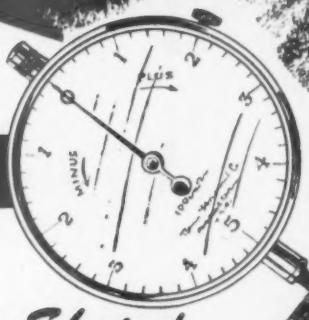
3. Each wheel trued and shaped after mounting on its spindle.
Result: Perfectly concentric; ready to use when you get it.

4. Completely uniform structure; pretested, positive bonding.
Result: Longer useful life; use them right down to the spindle.

BAY STATE

...s CO.

INDICATOR ACCURACY



Precision Shaped

on the spindle for perfect contour and complete concentricity.

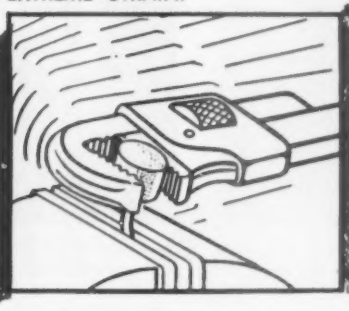
Deep-knurling

for EXTRA SAFETY, in high-strength alloy steel.
THE HEADS STAY ON!

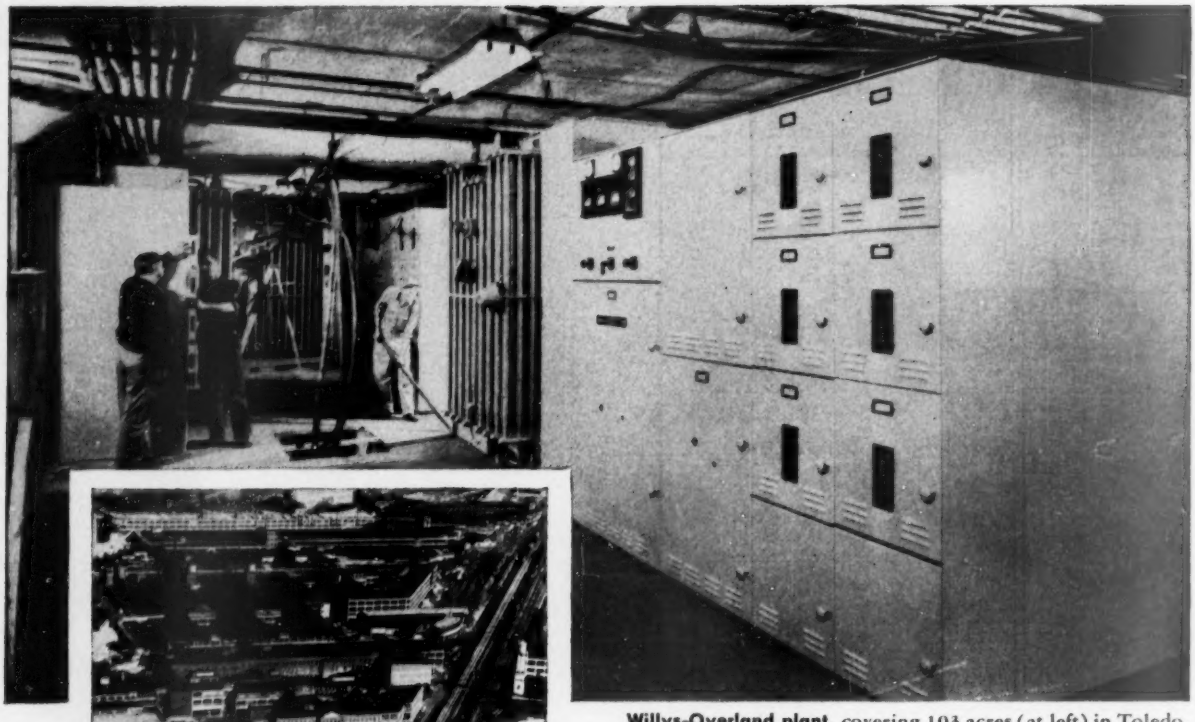
USE THEM . . .
Right down to the spindle!

Specially Bonded

Wrench-and-vise test proves its strength. This bond HOLDS, under EXTREME STRAIN.



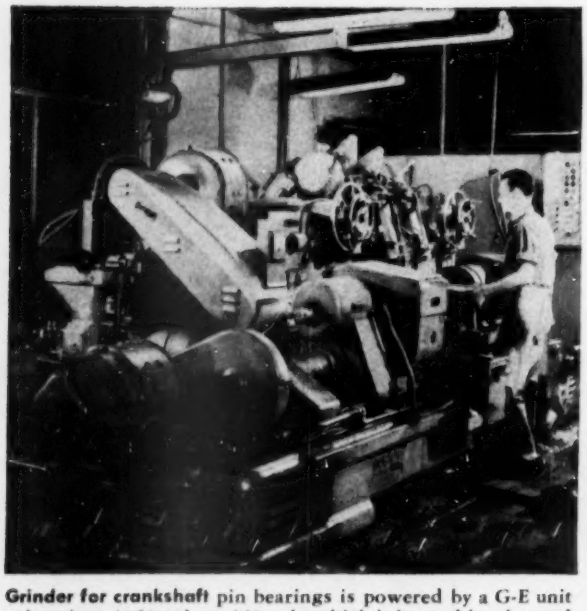
BAY STATE



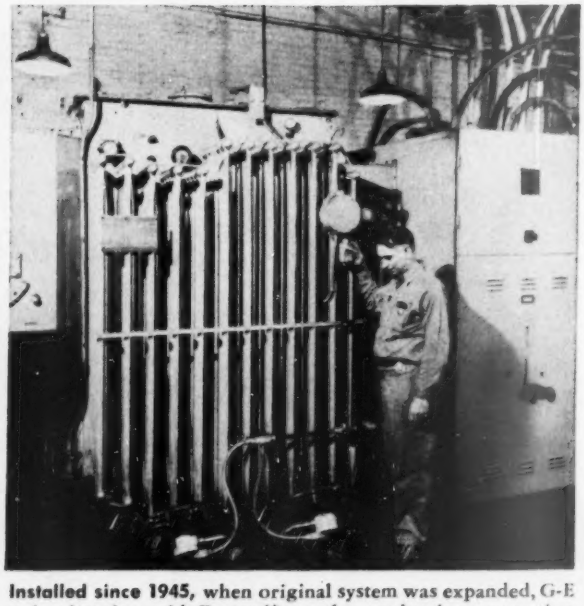
Willys-Overland plant, covering 103 acres (at left) in Toledo, O., adds five new G-E unit substations to expand simply and easily its radial distribution system. Total plant capacity is now 26,000 kva. Three of the 1,500-kva subs (above), with two others, furnish power to aircraft landing gear division.

AT WILLYS-OVERLAND—

One of nation's first load-center

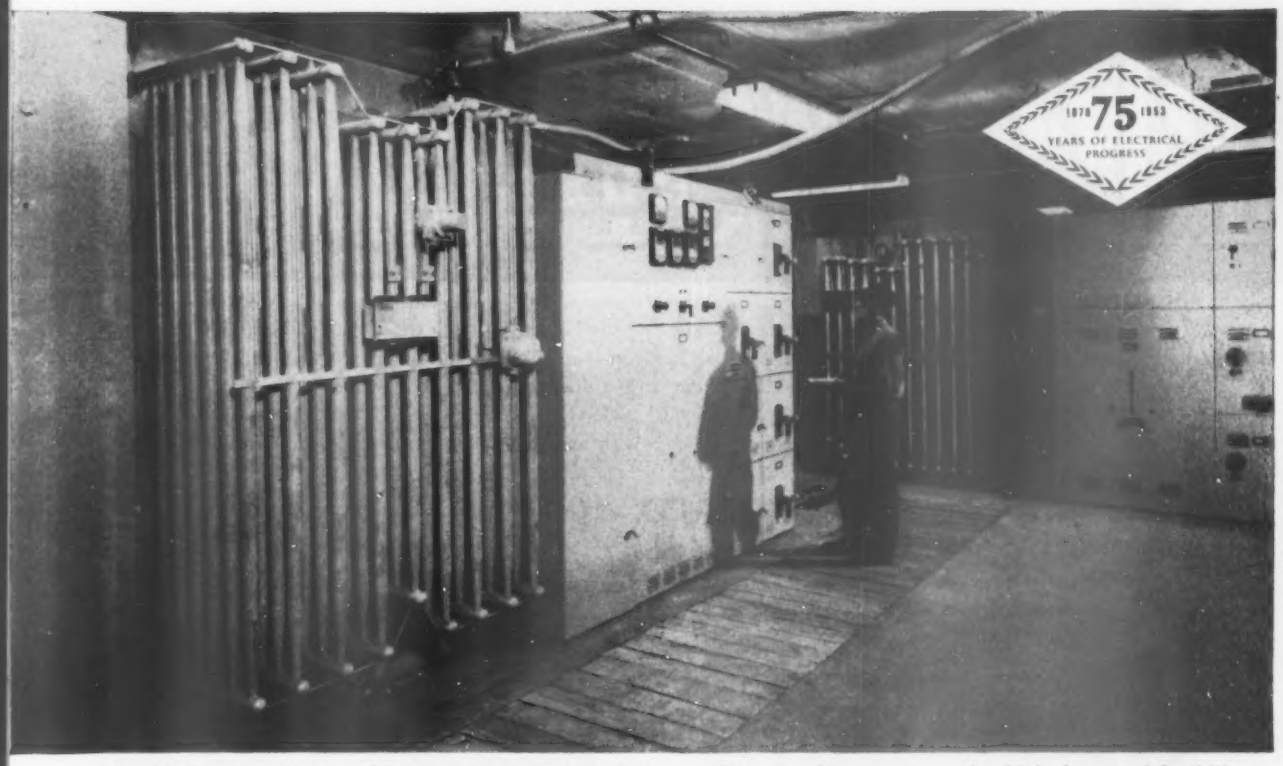


Grinder for crankshaft pin bearings is powered by a G-E unit substation, 4160-volt to 440-volt, which is located just beyond screen at left, adjacent to the load area.



Installed since 1945, when original system was expanded, G-E unit substation, with Pyranol* transformer, has been operating 24 hours a day, 5 days a week, with low maintenance cost.

*Reg. Trade-mark of General Electric Co.



New load-center units, are added to system which has operated for 13 years without power failure. Addition of new substations, like the two new 1,500-kva units above, does not alter over-all system, provides high degree of flexibility to handle shifts in plant loads. Unit subs, used as building blocks, can be placed wherever needed.

systems: Never a power failure!

G-E radial distribution system, installed in 1939, easily expanded to 26,000 KVA for increased plant loads

Flexibility in reliable power distribution for stepped-up production of Jeeps . . . quick, easy power expansion at little expense . . . low-cost maintenance with maximum safety. The Willys-Overland Company in Toledo found these advantages of its plant's radial distribution system multiplied when five new G-E 1,500-kva load-center substations were added recently for greater plant capacity.

During the past 13 years of trouble-free operation, engineers have had first-hand experience with the low cost, simplicity, and reliability of the radial system. A G-E outdoor unit substation furnishes plant power, steps down utility voltage to a usable 4,160 volts. Eighteen unit substations handle load requirements in more than two-score buildings on the 103-acre tract.

This installation is just one example of the way G-E engineering helps industry meet demands for more power. For further information, contact your G-E sales representative, or write for GEA-3592. General Electric Company, Schenectady 5, New York. 881-1

Outdoor G-E master unit substation, plus an indoor G-E station, furnishes power for 90 per cent of Willys-Overland capacity.

GENERAL ELECTRIC

PROTECTION AGAINST RUST for

Stop rust before it starts...with NO-OX-ID rust preventives that protect against corrosive elements chemically and mechanically. There is a Dearborn formula and application method suited to your operation. NO-OX-ID may be applied hot or cold dip—by hand or conveyor—sprayed or brushed on. And your products may be further protected by NO-OX-IDized wrappers. Wherever corrosion threatens you, get complete protection

...with Dearborn NO-OX-ID Rust Preventives

IN PRODUCTION • IN STORAGE

Invisible fingerprints can cause corrosion... result in rejects on machined parts with close tolerances. NO-OX-ID "493" removes fingerprints, gives the product a corrosion-protective shop coat to permit safe handling of the part during all phases of manufacture and inspection.

Dearborn NO-OX-ID rust preventives assure metal parts protection while in storage...in shipment...on dealer's shelves. Guard against rejects or costly refinishing operations that reduce profits. Contact Dearborn for assistance on the selection of the correct NO-OX-ID for your specific needs.

Dearborn
TRADE MARK

DEARBORN CHEMICAL COMPANY
MERCHANDISE MART PLAZA
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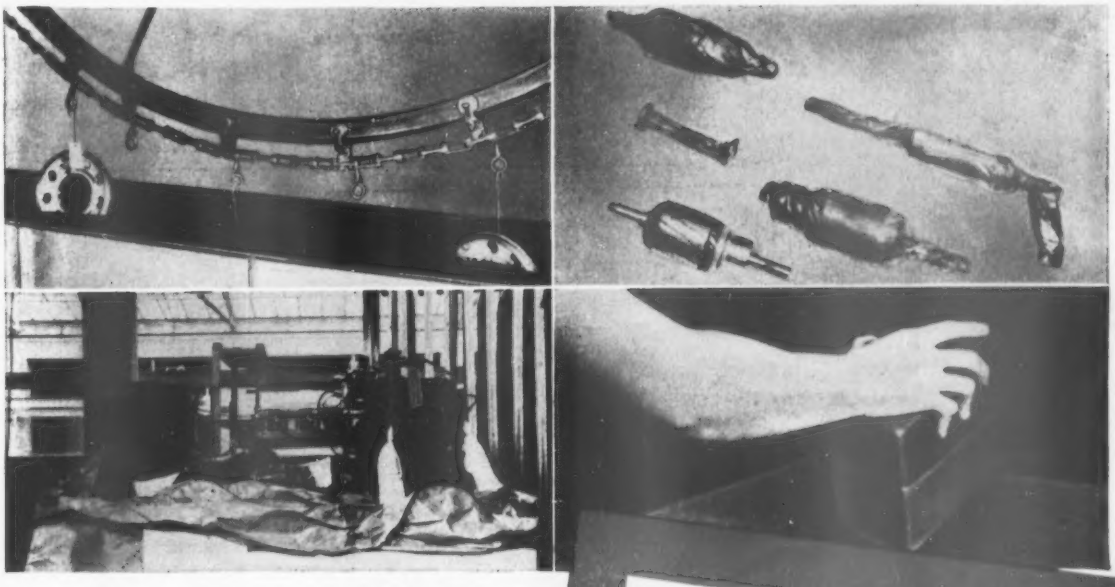
THE ORIGINAL RUST PREVENTIVE

NO-OX-ID

YOUR PRODUCTS



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Look to Dearborn's experience and know-how to solve your export packaging problems. Dearborn packaging engineers will gladly help you set up a procedure that fully conforms with government requirements for protection against rust and assures corrosion-free arrival of your products.

The Dearborn line of government specified packing materials includes rust preventives, wrappers, sealers, case liners, and fingerprint neutralizers. Other Dearborn materials include cleaners and VPI—the new barrier material that emits invisible protective vapors. Write for "Preventing Corrosion in Export Packaging."

Do you operate a Water Wall Spray Booth?

Control overspray due to fouled exhaust fans, clogged pumps and plugged water jets. It's easy and inexpensive with Dearborn Spray Booth Treatment. Ask for a demonstration on how Dearborn treats spray booth water to reduce maintenance costs and increase production.

Mail the Coupon!

INFORMATION ON THESE HELPFUL PRODUCTS AND SERVICES BELONGS IN YOUR FILES

Dearborn Chemical Company — Dept. F.
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Please send
- ☐ Your booklet "Preventing Corrosion in Export Packaging."
- ☐ Complete information on Spray Booth Treatment.
- ☐ Have a Dearborn Representative call.

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Company.....
Title.....
Address.....
City.....*Zone*.....*State*.....

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"Don't let it worry you. Everything is made fast with Phillips Cross-Recessed-Head Screws."

PERFECTLY MATED! Only Phillips Drivers are perfectly mated to Phillips Screws. Look for the name Phillips on the shank.

VIBRATION RESISTANCE because of added structural strength is only one of the exclusive advantages gained by using Phillips Screws. These screws set up tighter and their distinctive design gives them maximum strength of head. And that's not all. Because they are unusually easy to drive, they cut driving time up to 50%, eliminate driver skids and split screw heads. You save time, work, money when you use Phillips Screws — Wood, Machine, Tapping Screws or "Sems."

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It pays to "shop around" before you make your power transmission or conveyor chain selections. Because, in order to get the most for your money, you need the right chain for your machines. For example, a precision-finished roller chain is ideal for high speed drives. But, roller chain is not the economical, efficient choice for slow speed, heavy-duty service. A heavy-duty steel or cast chain may be your answer here. That's why it will pay you to "shop" through the *complete* Chain Belt line before you make your choice. There's a size and type to fit any power transmission or conveyor need.

Don't be handicapped by relying on a supplier with a limited line to answer all your needs. It may cost you more... may handicap the expected performance of your machines.

Your Chain Belt Field Sales engineer will be happy to assist you in making the exact chain selection that best fits your requirements. He is not prejudiced by the limitations inherent in an incomplete chain line... can recommend the chain that will give you the service you want... at the lowest possible cost. For complete information or engineering assistance, mail the coupon.

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Please send me information on Rex and Baldwin-Rex chains
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WHAT *Life-Line* REALLY DELIVERS IS MORE SERVICE...LESS SERVICING

Eliminate "lubrication confusion" with this modern motor!

Some motors require lubrication monthly, others yearly, still others have no definite schedules. They "just need it when they need it". It takes no great stretch of the imagination to see that schedules for greasing under these conditions pose a real problem. How can you do an accurate job? How do you eliminate overgreasing or undergreasing? In short, how do you eliminate these causes of failures?

One sure way: install modern *pre-lubricated* Life-Lines. Throw your schedules and grease guns away. The way to grease a modern motor is don't! Pre-lubricated Life-Lines *need no* further *lubrication.*

Records of over half-a-million motors, operating in every type of industry, show that pre-lubricated bearings offer 41% fewer motor outages due to faulty lubrication and at the same time give complete freedom from lubrication attention.

Today periodic lubrication is a costly, time-consuming nuisance. So why take a chance with it? Life-Line offers positive lubrication at no extra cost. See for yourself. Ask your Westinghouse representative for a copy of "Facts on Pre-lubricated Bearings", B-4378, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-21694-A

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How many people would to fill this one man's

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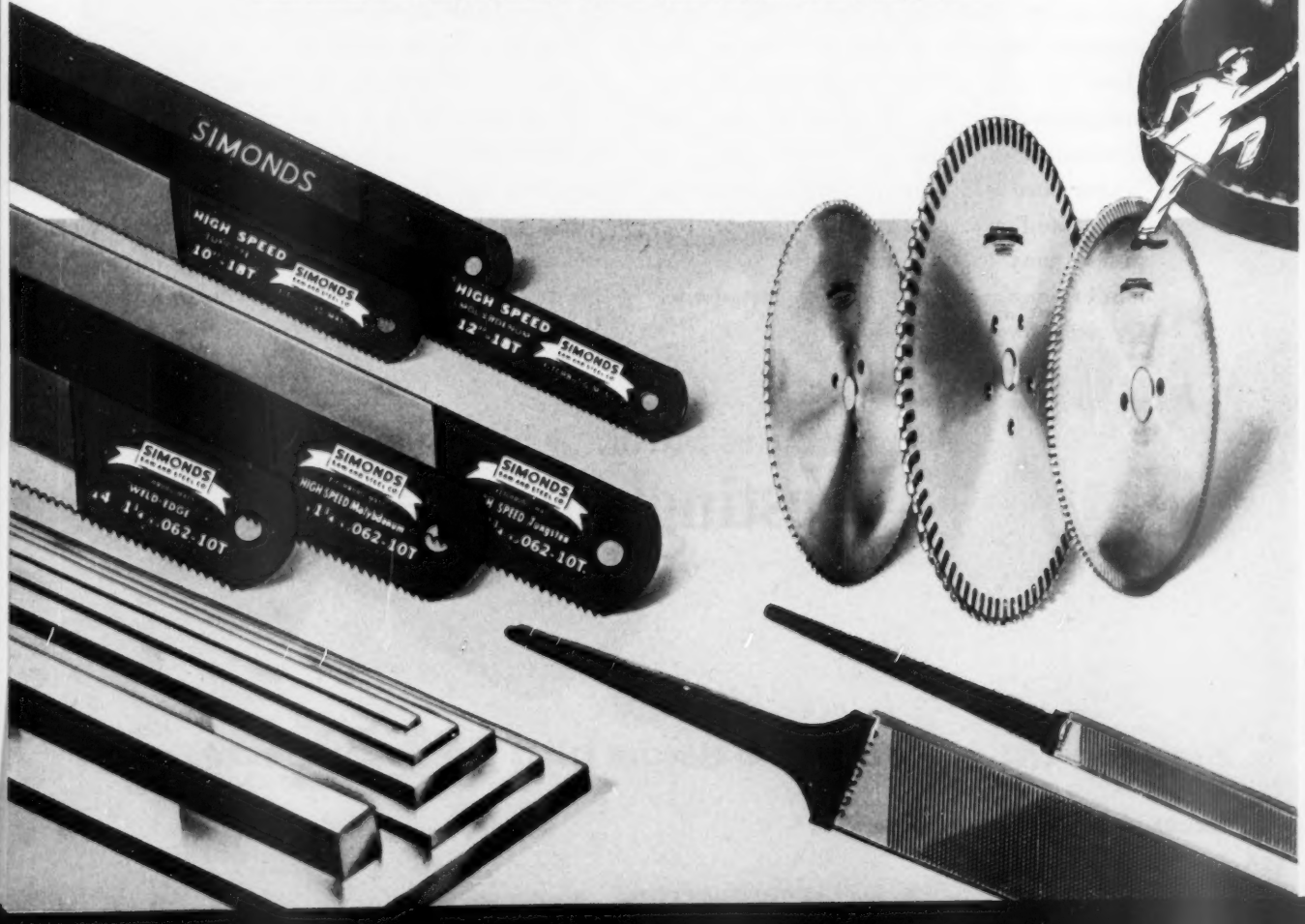

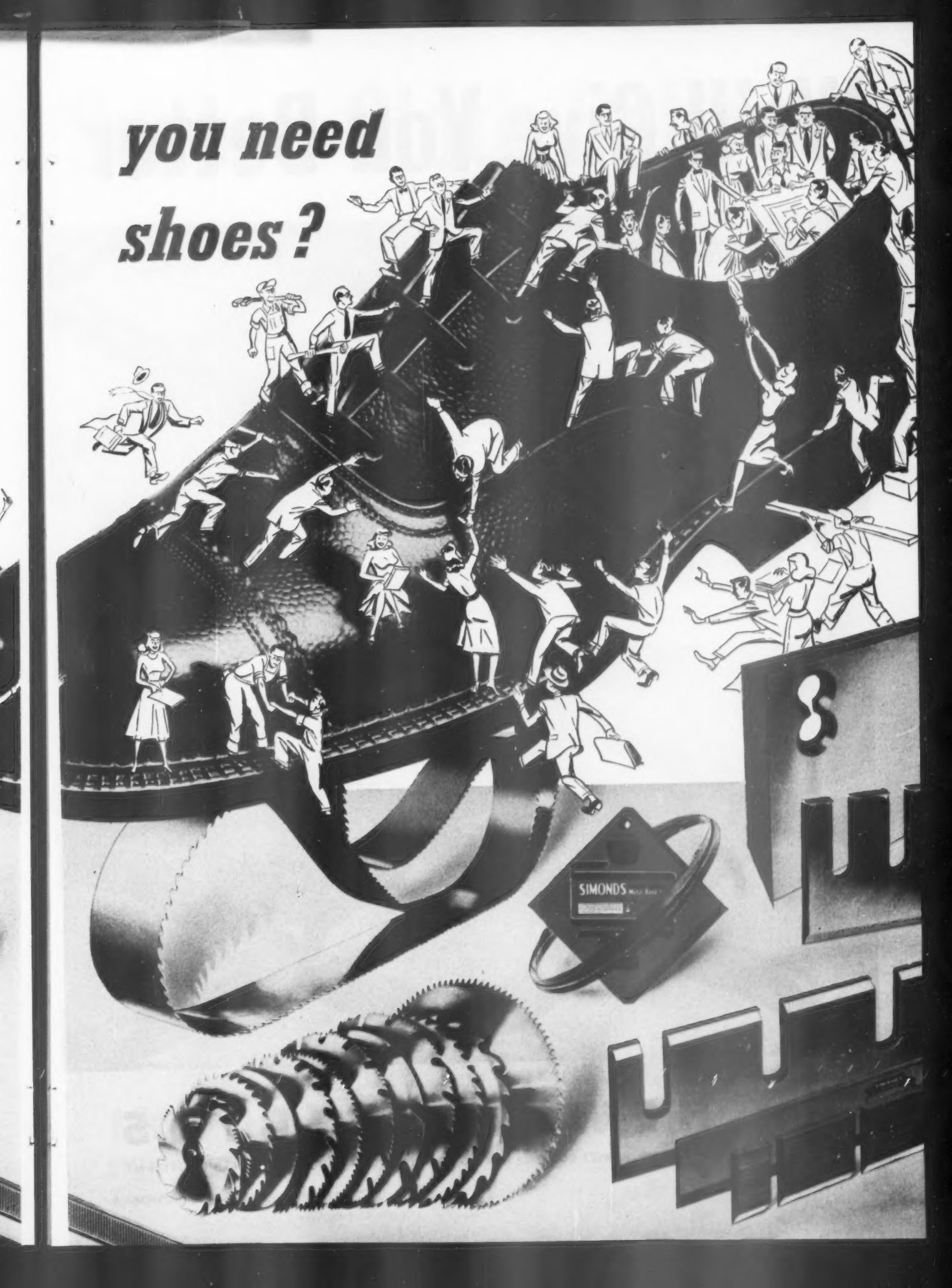
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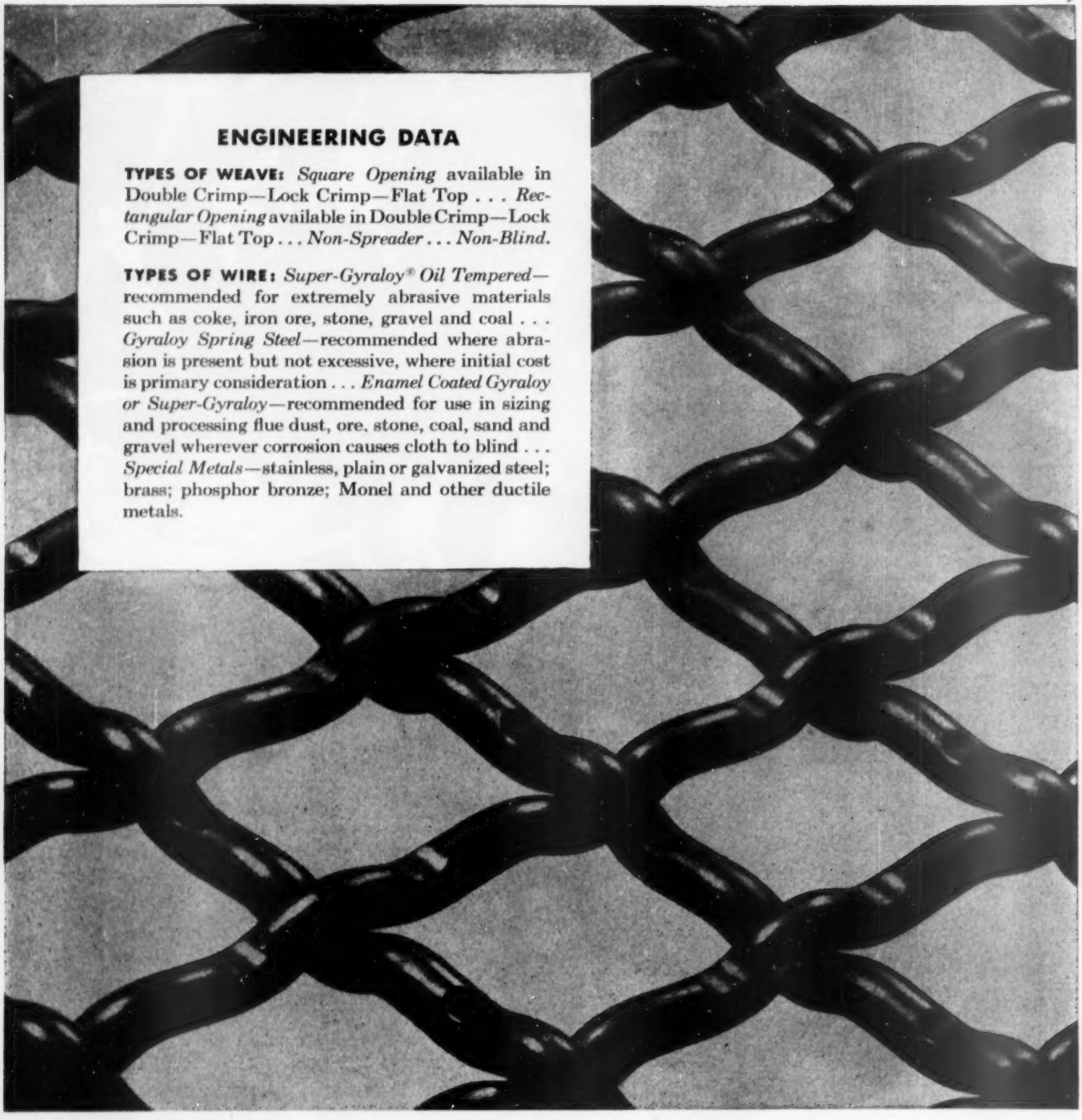

ENGINEERING DATA

TYPES OF WEAVE: *Square Opening* available in Double Crimp—Lock Crimp—Flat Top . . . *Rectangular Opening* available in Double Crimp—Lock Crimp—Flat Top . . . *Non-Spreader* . . . *Non-Blind.*

TYPES OF WIRE: *Super-Gyraloy® Oil Tempered*—recommended for extremely abrasive materials such as coke, iron ore, stone, gravel and coal . . . *Gyraloy Spring Steel*—recommended where abrasion is present but not excessive, where initial cost is primary consideration . . . *Enamel Coated Gyraloy or Super-Gyraloy*—recommended for use in sizing and processing flue dust, ore, stone, coal, sand and gravel wherever corrosion causes cloth to blind . . . *Special Metals*—stainless, plain or galvanized steel; brass; phosphor bronze; Monel and other ductile metals.

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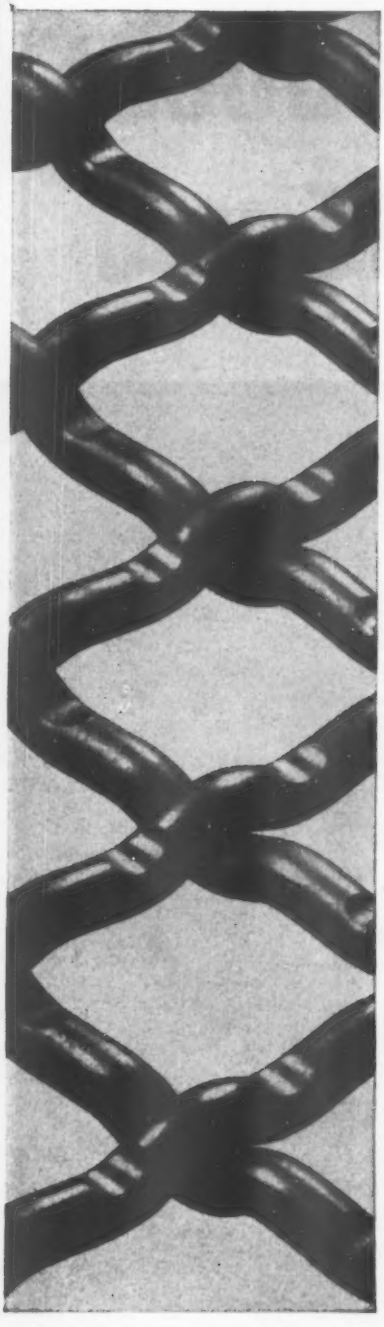

Increased Production Capacity Assures Faster Delivery For All Types Of Hewitt-Robins Screen Cloth

Now, we can give you faster delivery—*direct from our own modern plant*—of the finest quality screen cloth to meet your every need . . . Screen Cloth that gives you longer life, greater satisfaction on any type of screen, regardless of make . . . Screen Cloth that will provide you with highest efficiency, lowest cost per ton.

For shorter delivery on any type of Hewitt-Robins screen cloth send us this information:

1. Type of screen—Name of manufacturer—Model of machine.

2. Kind of screen cloth desired: Specify type *weave*—type of *wire*.

3. Size of clear opening or mesh and wire diameter.

4. Type of edge formation: Flat edges — Welded — Reinforced hook strips.

5. Length and width of panels (width measured from outside to outside of bent hooks)—Height and length of hook strips—Degree of angle inside of hook.

6. For rectangular, non-spreader or non-blind openings: Specify direction of long slot (which dimension of cloth it parallels).

7. For dewatering decks: Size of openings in mm—Single, double or no depressions—Round or triangular profile stainless steel rods.

WRITE FOR SCREEN CLOTH BULLETIN No. 113-A1

CHECK FOR INFORMATION ABOUT THESE JOB-TESTED PRODUCTS FOR YOUR OPERATION

CONVEYORS:
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*☐ —Hewlite® *☐ —Hot Materials
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*☐ —General Conveyor
☐ —Woven Wire

☐ BUCKET ELEVATORS
☐ IDLERS

SCREEN CLOTH:
☐ —Electrically Heated
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VIBRATING SCREENS:
☐ —Dewaterizers
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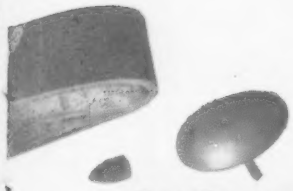

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and production time by the right choice of Coated Abrasives.

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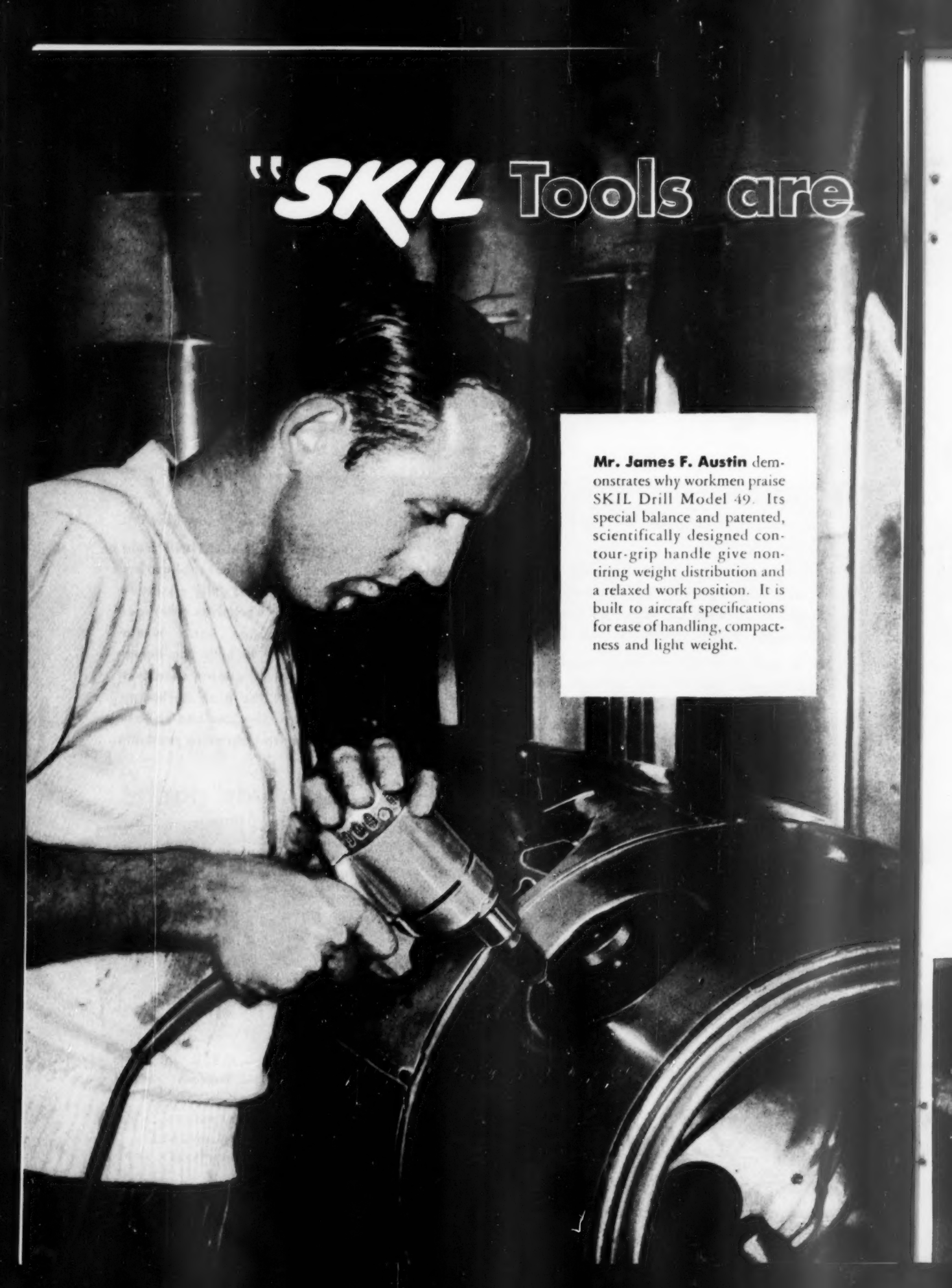

Mr. James F. Austin demonstrates why workmen praise SKIL Drill Model 49. Its special balance and patented, scientifically designed contour-grip handle give non-tiring weight distribution and a relaxed work position. It is built to aircraft specifications for ease of handling, compactness and light weight.

one secret of our record production"

"More than 130 SKIL Drills Have Helped Keep Smooth Production"

says **Mr. Martin Konoske,**
Production Superintendent
Fletcher Aviation Corporation,
Pasadena, California

"The most important single item here at Fletcher Aviation Corporation is meeting production schedules. We make good tanks and we're proud of them, but equally important is the 'on time' delivery stamp at the conclusion of our contracts," says Martin Konoske.

"In meeting these 'on time' deliveries, SKIL tools perform a very necessary function along our production line. We have standardized on SKIL portable drills," added Mr. Konoske. "More than 130 Model 49 SKIL Drills have helped greatly to keep our production lines running smoothly and aided us in producing more external fuel and napalm tanks for the Air Force than any other manufacturer. This pace-setting performance is the result of careful design planning, advanced tooling and a smooth-running production line."

Workman James F. Austin (see opposite page) explains this choice. He says, "Power, durability and handling ease . . . that's what sold me on SKIL Drills."

Learn more about what SKIL can do to speed production and cut costs for you. Contact your SKIL Distributor for help in selecting suitable SKIL Tools or phone or write the nearest SKIL Factory Branch.

Three SKIL Drills "gang up" to speed another step in assembly of airplane wing tanks.

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PORTABLE TOOLS

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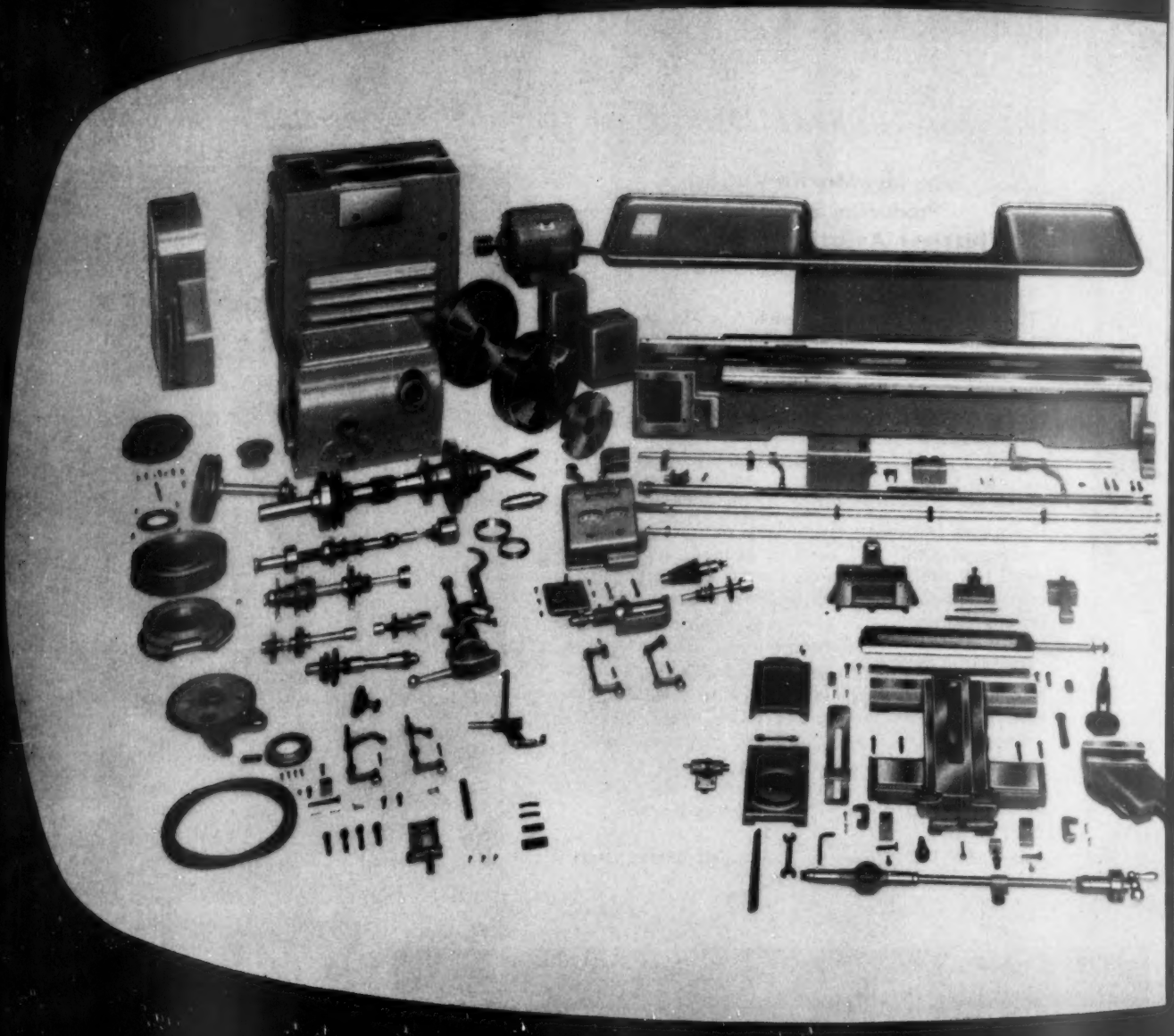

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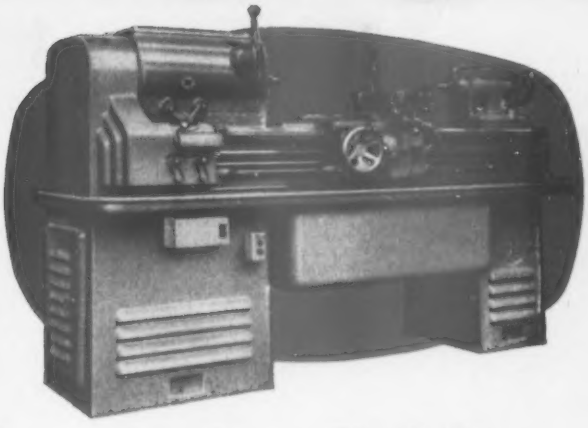
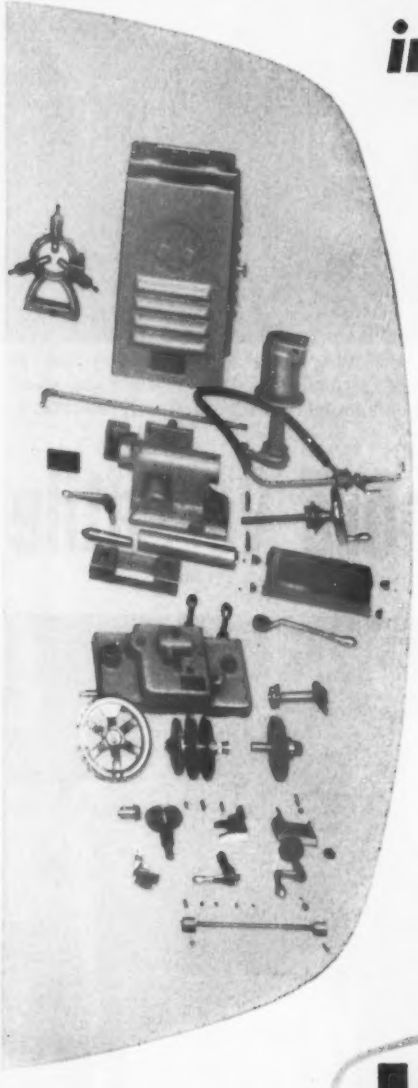
Dual-Drive

your best buy in the medium-price field





compare—
part by part, feature by feature...

FULL-POWER SPEEDS

Dual Drive's headstock design combines belt and gear drive to give you the widest range of speeds in its class—*all at full horsepower.* Twelve speeds from 28 to 1800 rpm.

OPTIMUM SIZE

15″ swing to take care of virtually all of your medium-duty turning. 30″ base center distance; more in increments of 12″.

BIG FEED-THREAD RANGE

Ninety-six feeds from .0004″ to .106″.
Forty-eight threads from 4 to 224.

CONVENIENCE

Single-lever speed control. Electric brake, forward and reverse spindle control at apron. Single-lever, positive-jaw feed control. Multiple automatic length stops. Many useful attachments.

ENDURANCE

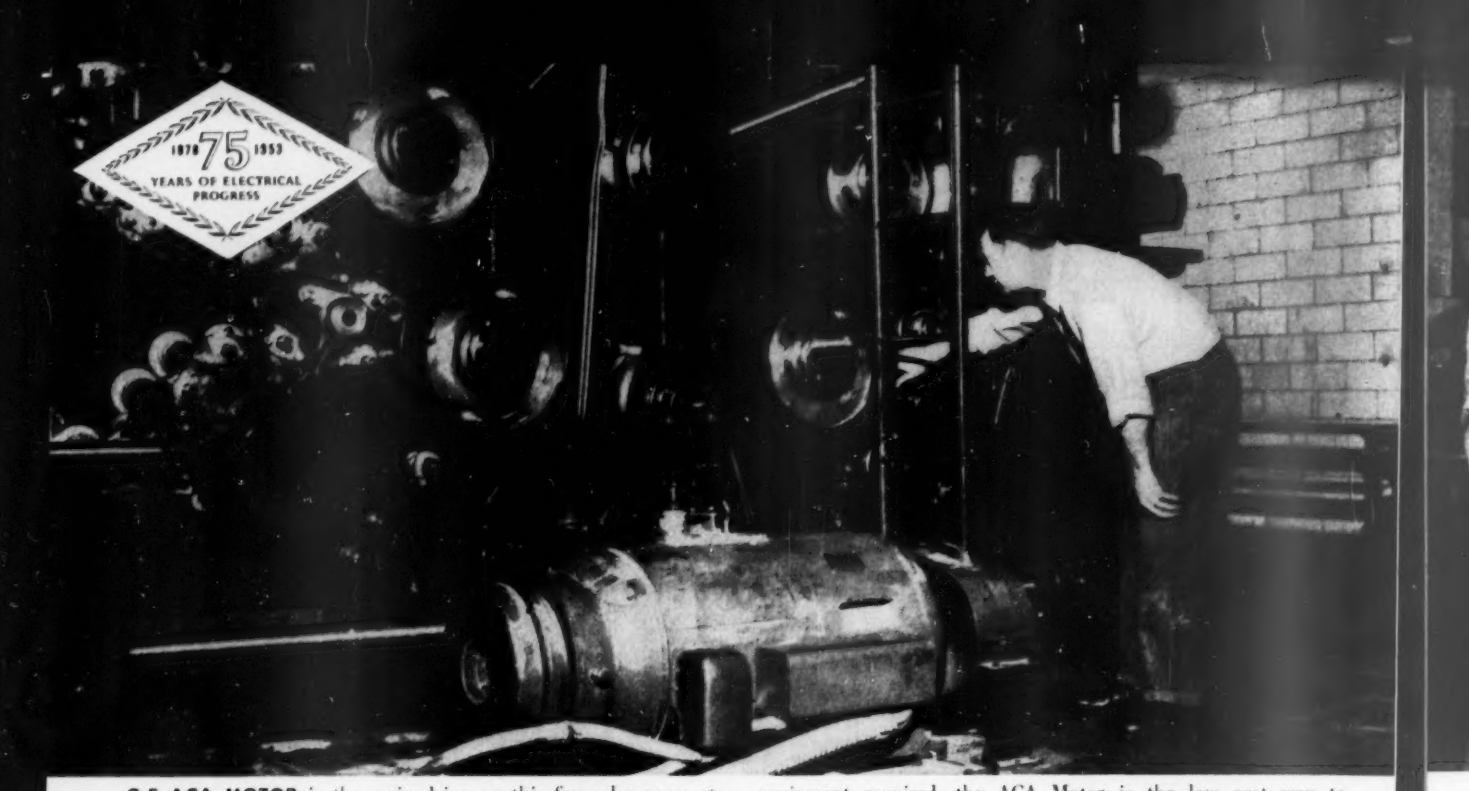
Totally-enclosed feed box. Automatic lubrication through headstock and feed box. Hardened steel gears and anti-friction bearings. One-piece, double-wall apron. Hardened and ground replaceable steel bed ways. American Standard taper key drive spindle nose.

turned faster by

LeBLOND *of Cincinnati*

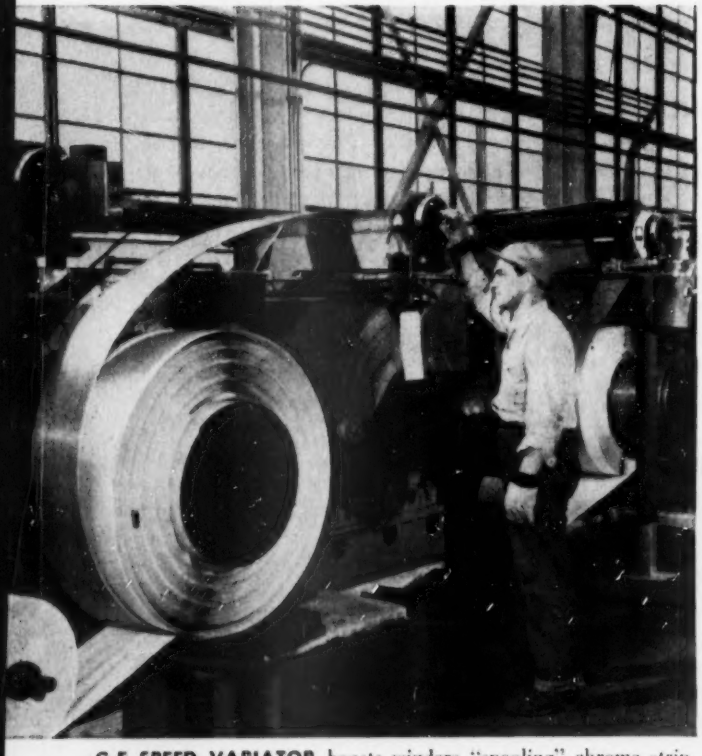
Your nearby LeBlond Distributor or the factory will be happy to give you the full story on Dual-Drive. Just ask for Bulletin 4H.

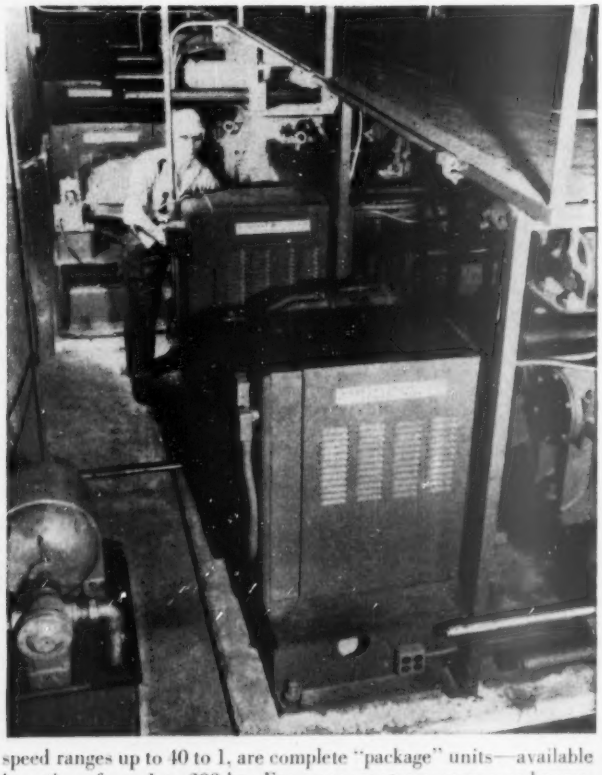
WORLD'S LARGEST BUILDER OF A COMPLETE LINE OF LATHES • *FOR MORE THAN 65 YEARS*



G-E ACA MOTOR is the main drive on this five-color press at Alford Cartons, manufacturers of folding boxes, Ridgefield Park, New Jersey. Working from AC current with no conversion equipment required, the ACA Motor is the low cost way to Adjustable-speed Drive performance. You get stepless speed adjustment within a speed range of from 3 to 1, 6 to 1, and 20 to 1.

Make your machinery more versatile





G-E SPEED VARIATOR boosts winders "spooling" chrome strip steel at Wallingford Steel Co., Wallingford, Conn.—handles all speeds from 5 to 80 feet per minute. G-E Speed Variators, with speed ranges up to 40 to 1, are complete "package" units—available in ratings from 1 to 200 hp. For even greater accuracy and versatility, these drives may include amplidyne or electronic regulators.

G-E THY-MO-TROL* DRIVE at the El-Ge Potato Chip Co., York, Pa., electronically regulates potato chip processing where accurate speed control is extremely important to the finished product. Thy-mo-trol drive is available between 1/40 and 75 hp, offers smooth speed adjustment ranging up to 100 to 1 and can be made to hold regulation as close as ±½% regardless of changes in voltage.

with a G-E Adjustable-speed Drive!

G-E ADJUSTABLE-SPEED DRIVES offer you the chance to get the most from your machinery investment. You can step up production, minimize material waste, improve product quality, and enjoy the ability to produce a greater variety of goods.

THERE IS A G-E ADJUSTABLE-SPEED DRIVE FOR YOU. Whether you need speed regulation within ±½% or ±10% you can get an economical Adjustable-speed Drive from the full G-E line. From the G-E ACA motor which requires but a simple twist of a dial . . . to the G-E Thy-mo-trol drive which permits precise electronically controlled drive speeds . . . General Electric manufactures a drive that will enable you to produce better and more uniform products. Packaged drives are available in sizes from 1/40 to 200 hp. Depending on hp, speed ranges are available from 3 to 1 up to 100 to 1.

FOR FULL INFORMATION consult your nearest General Electric Apparatus Sales Office. Your G-E Sales Representative will be glad to recommend the most economical drive best suited to your operation. For printed information on the complete line of Adjustable-speed Drives, use the coupon.

*Reg. Trademark of General Electric Company

You can put your confidence in—

GENERAL ELECTRIC

LET G.E. HELP YOU PICK THE RIGHT DRIVE

Because only General Electric makes all major types of electric adjustable-speed drives, it is best qualified to help you select the right drive. Send for these informative bulletins.

☐ **A.** This 26-page manual describes all four types of drives and where to apply them. Bulletin GEA-5334.

☐ **B.** Lower cost, simplest a-c drive. Bulletin GEA-4883.

☐ **C.** More flexibility, moderate cost. Bulletin GEA-5335.

☐ **D.** Top performance, 1/70—75 hp. Bulletin GEA-5337.

☐ **E.** Top performance, 1–200 hp. Bulletin GEA-5336.

General Electric Company
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☐ for reference only
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— Robert M. Feemster, Chairman of Exec. Comm., Dow-Jones & Co., Inc.

"You can't sit on the news!"

In 1940, The Wall Street Journal circulation was 29,000. Today it's 255,000 —and still climbing!

"Like any news," said Chairman Robert M. Feemster, "news of business is worthless unless it's fresh!

"We set out to make The Wall Street Journal the truly *national* business daily —one that would reach executive desks all over the country on the same morning. We first decentralized our printing plants—publishing in New York, San Francisco, Chicago and Dallas. But we still couldn't deliver fresh news from these points without the fastest, most *reliable* shipping service.

"That's why we called in Air Express.

"Now, 6500 pounds of Wall Street Journals go Air Express daily. Only hours later they're in a score of other major cities. And on practically every shipment, Air Express rates are the *lowest in the field.*

"We knew we could build circulation. We knew we had the news and features vital to American business. Our problem is to deliver the papers! Air Express helps solve it! If you're building circulation or sales, look into Air Express rates and benefits."

AIR EXPRESS

GETS THERE FIRST

Division of Railway Express Agency

"OUR ACCIDENT RATE DROPPED 75%"

with Du Pont Color Conditioning

—DETROIT STEEL CORP., PORTSMOUTH ROD & WIRE DIVISION

The intelligent use of color means profit. Through a scientific approach to color selection, Du Pont Color Conditioning lowered eyestrain and fatigue . . . boosted production for Portsmouth Rod & Wire Div. of Detroit Steel Corp.

An actual case history where this scientific painting plan reduced accident rates...improved morale and production

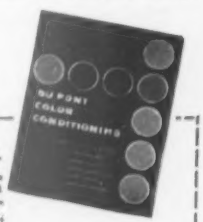
Mr. Uno V. Johnson, Superintendent of the Portsmouth Rod & Wire Division, Detroit Steel Corporation, Portsmouth, Ohio, reports, "When we adopted the Du Pont Color Conditioning plan in the first quarter of 1951, our accident-frequency rate stood at 9.2. Our records for the same period during 1952 show that this figure has been reduced to 2.3 —a drop of 75%. And the severity rate of these accidents has fallen from .90 to .37 . . . a drop of 59%.

"Our workers are certainly appreciative of the pleasant working conditions that have been accomplished and we have noticed that our employees take more pride in their work which reflects considerably in the quality and quantity of production."

Throughout hundreds of industrial plants, office buildings, hospitals, apartment buildings, schools, restaurants and stores, the value of Du Pont Color Conditioning is being proved every day. Scientifically selected paint colors have a subtle but positive effect on the mind. They improve morale and efficiency . . . result in lower operating costs.

Color Conditioning costs no more than ordinary maintenance painting . . . less in the long run. Discover all the ways Du Pont Color Conditioning can pay off for you. Mail the coupon today.

New Free 32-Page Book! *Find out how Color Conditioning can meet the specific needs of your plant. Get this new book, illustrated in full color. Mail the coupon today!*



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Chemically Engineered to do the job better

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BETTER THINGS FOR BETTER LIVING

. . . THROUGH CHEMISTRY

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Finishes Division, Dept. FM-33, Wilmington, Del.

Please send me, at no cost, your new 32-page book, "Du Pont Color Conditioning." I'm interested in Color Conditioning for ☐ industrial plants; ☐ hospitals; ☐ hotels and apartment buildings; ☐ schools, ☐ restaurants; ☐ stores; ☐ office buildings.

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Built in Horizontal (illustrated), Vertical Delivery and Power Throw types — 47 different models.

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Five popular sizes, A.G.A. approved for natural, mixed, manufactured, L.P. and L.P.-air gases.

Modine builds a unit heater to match your heating requirements

Whether it's steam, hot water or gas . . . look to Modine for the *right* unit heater

WHATEVER your unit heating requirements, you can match them exactly from the complete Modine line. Because Modine builds steam, hot water *and* gas-fired units, you're sure of an unbiased recommendation. And, remember, when you buy Modine, you buy the greatest name in unit heating. As a leader in this field for more than 25 years, Modine gives you balanced heating performance — perfect heating comfort plus maximum fuel economy. Get all the facts. See the Modine representative listed in your classified phone book, or write Modine Mfg. Co., 1505 DeKoven Ave., Racine, Wis.

Modine STEAM AND HOT WATER UNITS

Special heating coil designs for steam and for hot water assure best performance for each type of system. Discharge air temperatures of 110-120° F are correctly related to air velocity for heating at its best. All-copper coils defy corrosion because fins are bonded to tubes and tubes are brazed to headers. Pre-formed tubes with individual expansion bends absorb stresses, assure long life.

Modine GAS-FIRED UNITS

Modine is the only gas unit with both *stainless steel* heat exchanger and burner. Lighter weight means easier, less expensive installation, plus faster heat delivery — *within five seconds* after thermostat calls for it. Individually fired tubes provide higher heat transfer. Elongated ports — four times free area of conventional drilled ports — minimize clogging and simplify routine cleaning.

U-1186

Ask for Bulletin 149-A on steam and hot water and Bulletin 652 on gas unit heaters

Modine UNIT HEATERS

You can't stop a rhino with a popgun

You can't stop corrosion with ordinary paints ... it takes BITUMASTIC COATINGS!

CORROSION can't be stopped by ordinary paints or conventional protective coatings. They can't protect surfaces against the ravages of rust for any appreciable length of time. But Bitumastic Coatings can. Here are three principal reasons:

1. Unlike maintenance paints, Bitumastic® Protective Coatings are specially formulated from a coal-tar pitch base* that is, for all practical purposes, impervious to water. When you keep moisture away from an exposed surface, you *stop* corrosion.

2. Bitumastic Coatings provide an extra-tough, extra-thick barrier against corrosive elements—a barrier that is impenetrable. These coatings provide up to 8 times the film thickness of conventional paint coatings.

3. Bitumastic Coatings stop corrosion caused by moisture—acid fumes—alkaline fumes—corrosive soil—salt air—heat.

**Hi-Heat Gray contains a metallic base.*

There are 6 Koppers Coatings—formulated to control corrosion of metal and deterioration of concrete. Use the coupon for full information, or see our catalog in Sweet's Plant Engineering File.

SEND FOR SET OF FREE BOOKLETS!

Koppers Company, Inc., Tar Products Division
Dept. 353-T, Pittsburgh 19, Pa.

Please send me, without charge or obligation, complete information on corrosion prevention.

Name .....

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City ..... Zone ..... State .....

KOPPERS BITUMASTIC PROTECTIVE COATINGS — SOLD THROUGH INDUSTRIAL DISTRIBUTORS

KOPPERS COMPANY, INC., Tar Products Division, Dept. 353-T, Pittsburgh 19, Pa.

DISTRICT OFFICES: BOSTON, CHICAGO, LOS ANGELES, NEW YORK, PITTSBURGH, AND WOODWARD, ALA.

SEALMASTER *Ball Bearing Units*

With ZONE HARDENING*

ZONE HARDENING is a completely automatic heat treating process by which the inner race ring of SEALMASTER Ball Bearing Units is hardened—through the ball path section only! (See 1 in cutaway view.) The extended part of the inner race is left in its original metallurgically soft tough state. Hardened set screws are mounted through this soft portion of the race (See 2 and 3), permitting race-to-shaft locking with increased holding power and greater resistance to shock and vibration. Firm lock of bearing to shaft minimizes danger of fretting corrosion and eliminates shaft wear.

SEALMASTER first introduced the self-aligning, permanently sealed, industrial ball bearing unit . . . the outer race locking pin . . . the ball retainer riding the inner surface of the outer race ring—and now Zone Hardening—all patented features!

SOME IMPORTANT SEALMASTER FEATURES

PERMANENTLY SEALED, SELF-ALIGNING BALL BEARING
. . . has felt-lined steel flingers rotating in labyrinth to prevent entry of dirt and to retain proper amount of lubricant (see 4).

LOCKING PIN AND PERIMETER DIMPLE
. . . prevents bearing from spinning in its housing and prevents fretting corrosion between housing and bearing, yet permits sufficient shaft alignment without seal distortion (See 5 and 6).

BALL RETAINER
. . . rides on the ground inner surface of the outer race ring (See 7), eliminates ball wear, trapping grease and preventing its churning in the bearing.

SEALMASTER Units are available in many special housings as well as in the complete standard line. Write us for full details on special units. Ask for a copy of SEALMASTER Catalog 845.

*Patented—exclusively SealMaster's

SEALMASTER BEARINGS
1 RIDGEWAY AVENUE, AURORA, ILLINOIS
A DIVISION OF STEPHENS-ADAMSON MFG. CO.

FACTORY REPRESENTATIVES AND DEALERS IN ALL PRINCIPAL CITIES

"THEY SAY THAT SOME SHEAVES CAN EASILY BE MOUNTED IN ONE PIECE AND GIVE THE SAME SHAFT GRIP AS THE TWO-PIECE DESIGN
NO, CHARLIE... LISTEN- THE SHEAVE THAT GRIPS THE SHAFT TIGHTEST IS THE ONE THAT'S DESIGNED TO BE MOUNTED IN TWO PIECES!

FIGURE 1—TO MOUNT THE QD IN TWO PIECES you (1) slide the split hub on the shaft, (2) position it with the locking clamp-screw in the flange, (3) draw down on the set-screw over the key (QD exclusive) to prevent it from drifting, (4) slide the QD rim with its large taper bore opening up on the taper of the hub, (5) draw up on three heavy hex-head pull-up bolts for a tighter grip than you get with any other sheave.

FIGURE 2—TO MOUNT THE QD AS A UNIT where a Woodruff key is used in a shouldered shaft, you (1) locate the loosely assembled hub and rim of the QD sheave against the shaft shoulder and (2) draw up on the three heavy hex-head pull-up bolts. That's all there is to it. And you haven't sacrificed any grip on the shaft. For removal, you simply use pull-up bolts as jack bolts in specially tapped holes.

Let's settle this one RIGHT NOW!

You can't have your cake and eat it too.

A one-piece sheave assembly may grip the shaft sufficiently tight for average use, but it *won't keep the shaft key from drifting.* Your answer to this problem lies in an *exclusive* key set-screw in the hub of the *two*-piece Worthington QD* Sheave. The set-screw is tightened with the hub on the shaft before the rim is slipped on (figure 1).

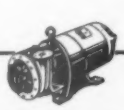
Of course, if you use a Woodruff key in a shaft with a shoulder, drifting of the key is no problem and you then can mount the Worthington QD assembled in *one* piece *without any sacrifice of its famous friction-cone grip* (figure 2).

WORTHINGTON'S COMPLETE LINE OF MULTI-V-DRIVES includes QD sheaves in all sizes, QD Juniors and other fractional horsepower V-pulleys, as well as Worthington-Goodyear V-belts. Your distributor has complete stocks backed by the largest factory stocks you'll find anywhere. Write for Bulletin V-1400-B7F to Worthington Corporation, Oil City, Pennsylvania.

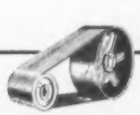
*Reg. U. S. Pat. Off.

MV.2.7

COMPRESSORS: AIR-COOLED, WATER-COOLED



PUMPS: CENTRIFUGAL, ROTARY, STEAM, POWER



MULTI-V-DRIVES: QD SHEAVES AND V-BELTS

VARIABLE SPEED DRIVES: ALLSPEED DRIVE, ALLSPEED MOTOR DRIVE

WORTHINGTON

Multi-V-Drives

Buy these Worthington standard products from your local distributor

new Willson

BRONZE

safety spectacles

combining ***eye protection*** *with the* ***color styling*** *workers want today!*

Style WB—choice of new spatula temples as shown, or half-plastic, half-cable type temples. Style WBS—has matching bronze sideshields.

Not one, but *two* new features make these sturdy safety spectacles an exceptional value. Their distinctive bronze color gives them a pleasing appearance. And the new non-flammable frame is toughest plastic made for spectacles—won't chip, crack or craze—and has greatest shock resistance.

Willson Bronze styles feature the "keyhole" bridge and popular Hi-Line® temple. Brand-new wire core spatula temples add an extra comfort feature you'll welcome. They're easy to adjust for a perfect fit!

These attractive spectacles are available with Super-Tough® heat treated glass lenses or Willson Plas-Tough® plastic lenses. A full range of eye and bridge sizes make these spectacles ideal for use with prescription lenses. See your nearest Willson distributor for these new Willson Bronze styles—or write for descriptive bulletin.

For those who prefer flesh-colored plastic spectacles, with the same safety and comfort features and choice of temples, see Style WK and Style WKS.

More than 300 Safety Products *Carry This Famous Trademark*

WILLSON®

Established 1870

WILLSON PRODUCTS, INC., 218 WASHINGTON ST., READING, PA.

GET THEM ANYWHERE

Over seventy Willson distributors with more than 400 salesmen offer you speedy service throughout the United States and Canada—give you off-the-shelf delivery wherever you are.

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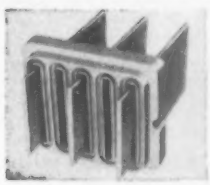
for more efficient, economical power distribution

FA POWERPLUGIN

For safe, efficient, flexible, economical and dependable power distribution for machines and lights in industrial plants, Ⓕ POWERPLUGIN Busduct is unsurpassed.

- Made in standard 10-foot lengths with a plugin outlet every foot of the way in one side, or alternately in two sides, Ⓕ POWERPLUGIN makes power available where and when it's needed.
- It enables machines to be relocated and regrouped without disrupting production, eliminates temporary connections and long leads, cuts maintenance costs and affords other big savings by reducing power loss and voltage drop to a minimum. Too, it's 100 percent salvageable.
- Underwriters' Laboratories' approved, Ⓕ POWERPLUGIN is available in capacities of 250 to 1000 amps, 600 volts AC or less with Klampswitchfuz, Shutlbrak or Circuit Breaker plugin units for 200 amps or less.
- If you want greater plant efficiency Ⓕ POWERPLUGIN is the answer. For further information contact your nearest Ⓕ representative, listed in Sweets or write for bulletins.



Features of Ⓕ POWERPLUGIN

Ⓕ POWERPLUGIN is made of 16-gauge steel with attractive gray enamel finish. It is only 7 inches wide, 4 inches deep for 600 amps and less and 6 inches deep for 800 and 1000 amps, permitting its use in restricted areas.

Insulators are one-piece glazed porcelain with steel channel supports riveted into position.

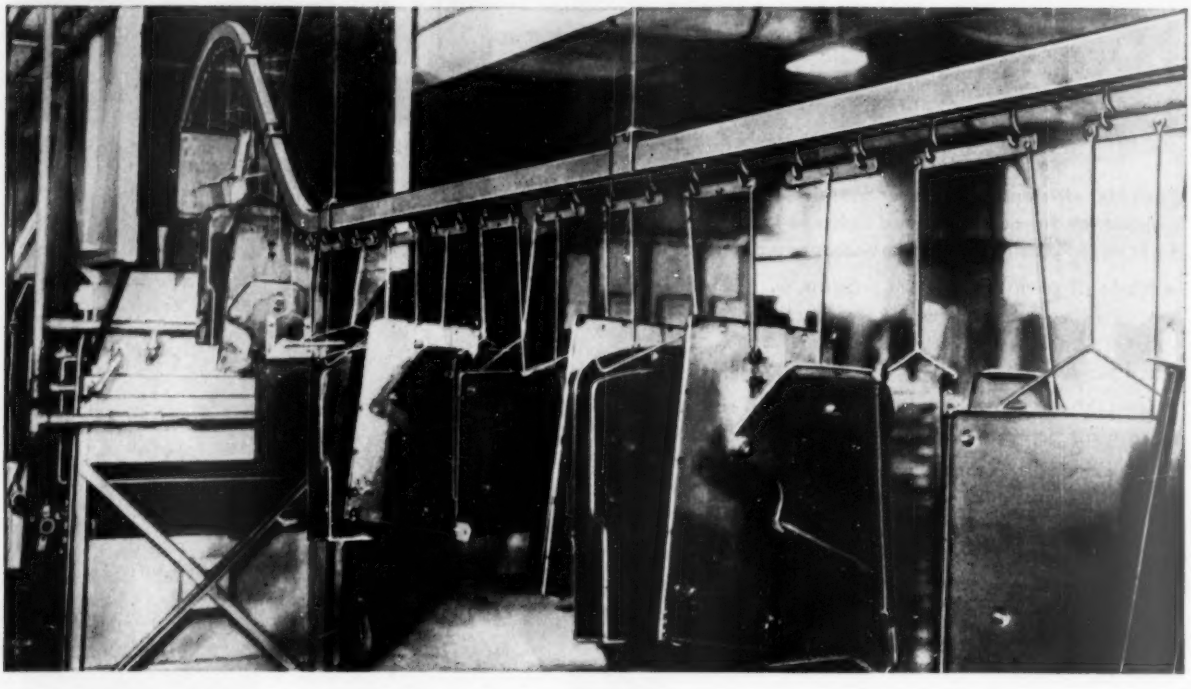
Sliding cover type plugin openings, simplified adjustable, two-screw type fasteners for plugin units, two sliding type mounting brackets per section for hanging as desired, electro-silver plated contact surfaces at joints with two or four brass jam bolts with phosphor bronze cup washers in elongated fastening holes are other features.

Frank Adam Electric Co.

P. O. BOX 357 ST. LOUIS 3, MISSOURI

FA TRADE MARK

For fast, sure, low-cost production it's *Richards-Wilcox* CONVEYORS



Efficiency—that's a word that means faster production, more profits for you. And efficiency is the word for Richards-Wilcox Conveying Equipment. R-W Conveyors speed up production by cutting down on handling time and releasing plant personnel for other jobs.

There's an R-W Conveyor for industry of all types—for handling of light, medium and heavy materials. You can boost production, cut costs and increase efficiency with Richards-Wilcox Conveying Equipment. Why not have an R-W consultant show you how you can lick your production problems with conveyor equipment engineered exactly to your own particular requirements. Just write or phone the nearest R-W branch office for free consultation—there's absolutely no obligation.

ONE OF THESE INSTALLATIONS IS RIGHT FOR *YOU*

"ZIG-ZAG" Continuous Power Conveyors—Unique powered chain conveyor with extreme flexibility. Designed especially for carrying light loads within confined areas—handles products through degreasers, dip tanks, spray booths, ovens, etc., (shown above).

"LOCK-JOINT" Trolley Track OveR-Way Conveyors—Designed for handling light to medium loads, and maximum flexibility. Maximum capacity 3,000 lbs.

"TRU-TRED" Steel Beam OveR-Way Conveyors—For heavy duty handling and electric hoist service with minimum superstructure—eight different track sizes. Maximum capacity 8,000 lbs.

1880 RICHARDS WILCOX R-W AURORA TRADE MARK Reg. U. S. Pat. Off. 1953

OVER 73 YEARS

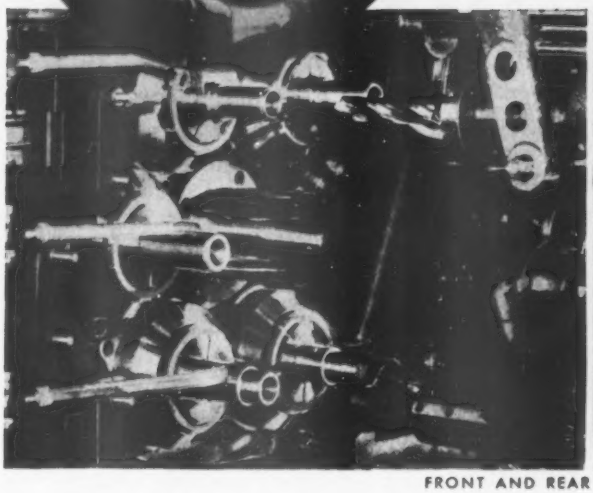
Richards-Wilcox Mfg. Co.

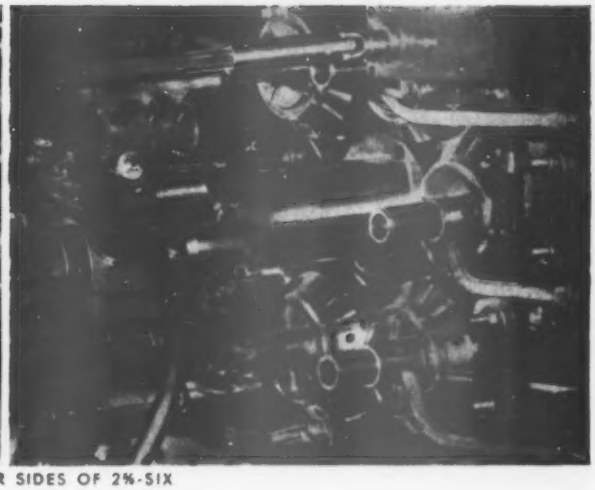
"A HANGER FOR ANY DOOR THAT SLIDES"

AURORA, ILLINOIS, U.S.A. *Branches in all principal cities*

SLIDING DOOR HANGERS & TRACK • FIRE DOORS & FIXTURES • GARAGE DOORS & EQUIPMENT
INDUSTRIAL CONVEYORS & CRANES • SCHOOL WARDROBES & PARTITIONS
ELEVATOR DOOR OPERATING EQUIPMENT

NO NEED TO "SETTLE" FOR LESS





FRONT AND REAR SIDES OF 2⅝-SIX

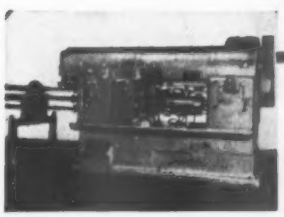
Multiple Spindle Bar Automatics produce more work per square foot of floor space than do other types of metal cutting machine tools. But, when *one* spindle is "down" *all* are "down." It's why dependability will always be the outstanding requirement of the "Automatic."

So many factors are involved in dependability that any weakness in design, engineering, material, or construction, will eventually contribute to higher costs of operation and maintenance.

Part of any new machine's service to the prospective user is the availability of *full* information. No prospective purchaser need "settle" for less. At least it's that way with CONOMATICS.

In producing the piece shown, on a 2⅝-SIX, the eccentric forming attachment (see upper right illustration) combines the well known CONOMATIC facilities of form tool support and "all position" attachment spindle drive.

A Comparison of ALL Automatics is in favor of Cone



Conomatic CONE AUTOMATIC MACHINE COMPANY, INC. WINDSOR, VT., U.S.A.

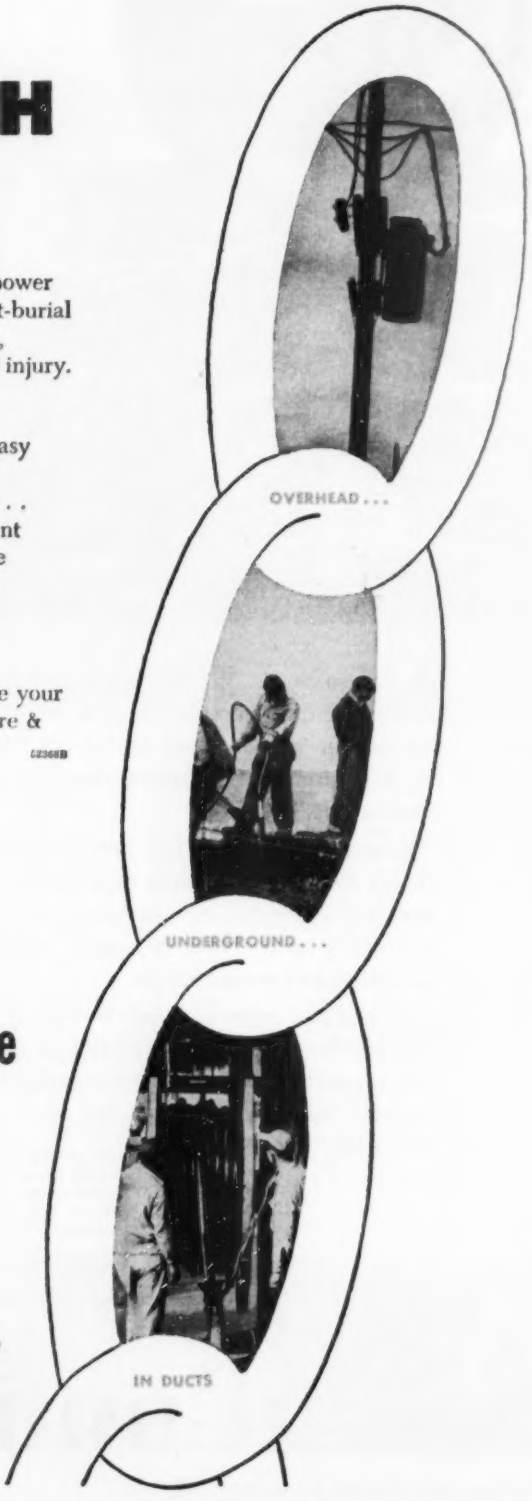
NO WEAK POWER LINKS

with DURASHEATH

ALL-PURPOSE DURASHEATH* can be used for every type of power and lighting application. In combined duct, aerial and direct-burial use, Durasheath effectively resists electrolysis, condensation, weathering, sunlight, organic decay, abrasion, and mechanical injury.

DURASHEATH COSTS LESS to install . . . because it is flexible, easy to handle, light in weight. It may be run in one continuous length *without expensive splicing*. It costs less to maintain . . . because its tough neoprene jacket can take terrific punishment in any use. It costs less to stock . . . because, instead of three cables, one – versatile Durasheath – meets every electrical distribution requirement.

USE DURASHEATH for economy, reliability, and durability. See your nearest Anaconda Sales Office or Distributor. Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York. 52368B



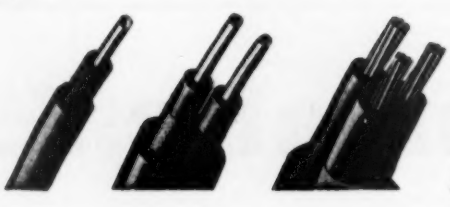
the right cable for the job

ANACONDA® wire and cable

for traffic control, airport† power and lighting, mines, industrial plants, railroads, street lighting, and many other uses.

available in all sizes–from large to small–single and multi-conductor.

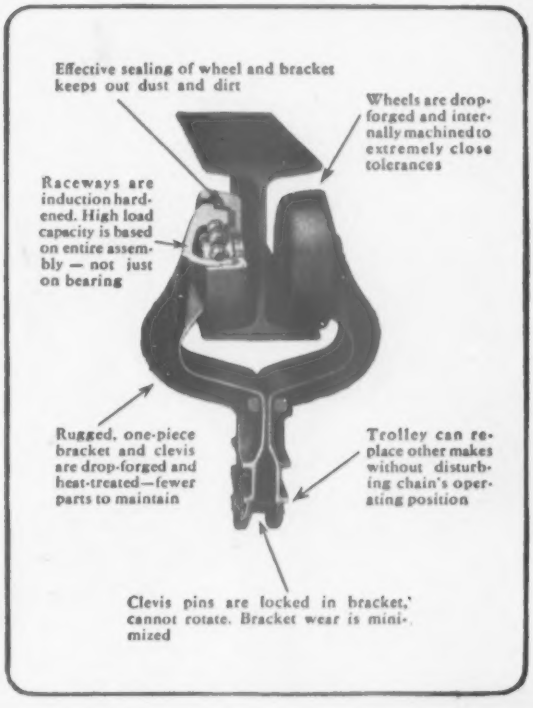
*Trademark
†when ordered to CAA Specification L-824.

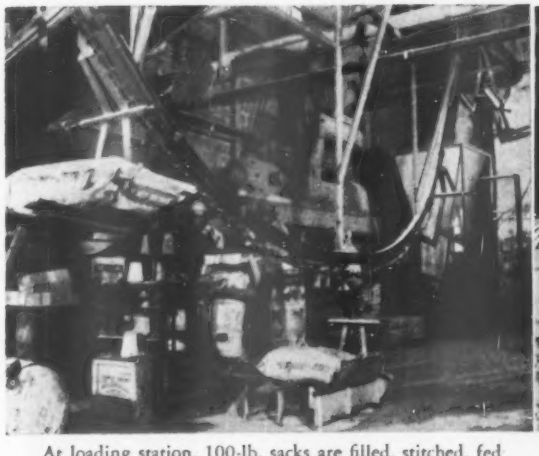


When you buy TROLLEY CONVEYORS . . .

LINK-BELT GIVES YOU BOTH!

Superior components → plus engineering ingenuity


Effective sealing of wheel and bracket keeps out dust and dirt
Wheels are drop-forged and internally machined to extremely close tolerances
Raceways are induction hardened. High load capacity is based on entire assembly — not just on bearing
Rugged, one-piece bracket and clevis are drop-forged and heat-treated—fewer parts to maintain
Trolley can replace other makes without disturbing chain's operating position
Clevis pins are locked in bracket, cannot rotate. Bracket wear is minimized



At loading station, 100-lb. sacks are filled, stitched, fed onto pick-up rack and lifted automatically by two-finger carriers onto L-B multiplane trolley conveyor.

Sacks are carried overhead through warehouse to truck dock or any of seven railroad loading docks. Portable discharge chute permits unloading at any point. Bags drop on rollers to shoulder height.

Note four of the important advantages which you get with Link-Belt Overhead Trolley Conveyors —

Quick, direct flow, regardless of physical layout. Saving of floor space. Better working conditions. Synchronization with other conveyors.

Results like these are yours when you tap industry's greatest source of materials handling and power transmission experience. Your operating and maintenance costs are reduced with Link-Belt ball bearing trolleys.

Put Link-Belt engineering ingenuity and quality products to work for you. Our engineers will work with you or your consultants to help set up smooth, steady, profitable straight-line production in your plant.

LINK-BELT

OVERHEAD TROLLEY CONVEYORS

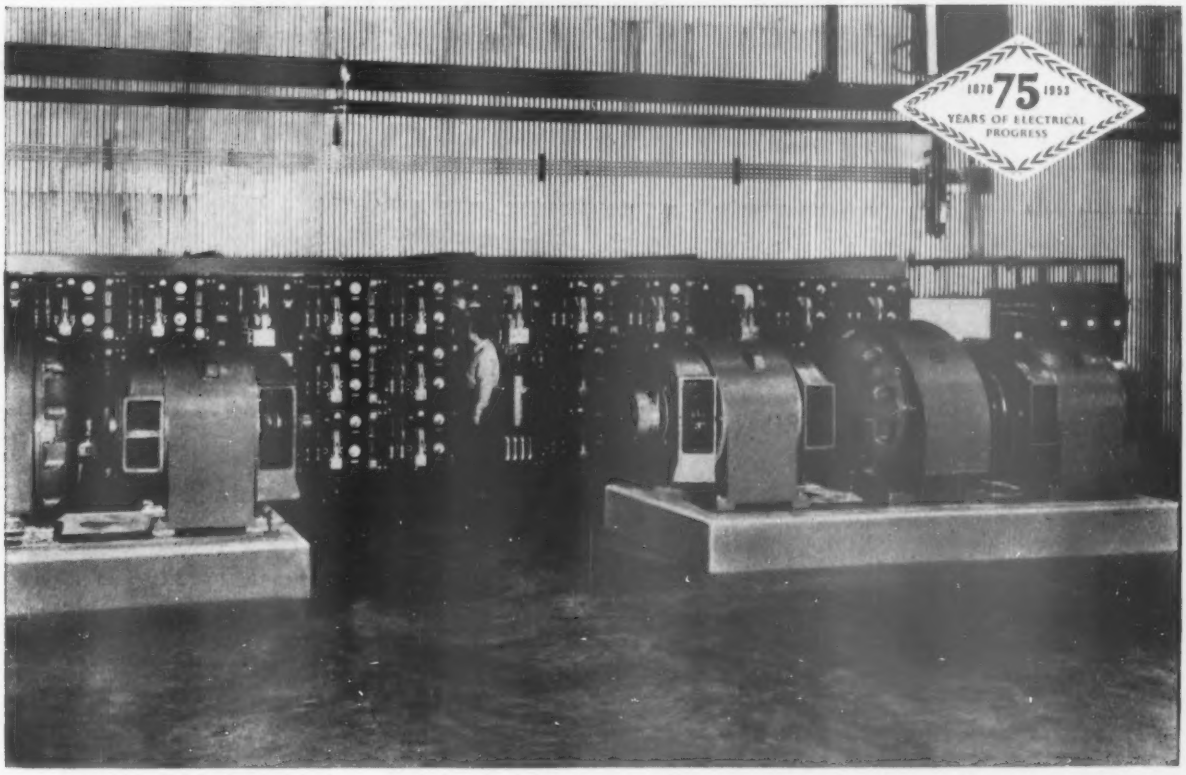
LINK-BELT COMPANY: Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Springs (South Africa). Offices in principal cities. 12,507-R

LARGE INSTALLATION of metallic-rectifier chargers provides a flexible power supply which is economical regardless of charging load. Grouping permits central record keeping and supervision. Since no special foundation is required, individual units may be added or removed or entire station relocated to meet changing needs. Each unit can be used to charge a variety of batteries.

Eliminate guesswork in

FOR SMALLER OPERATIONS, and to save time by spotting chargers throughout large plants, individual metallic-rectifier chargers are ideal. Automatic controls assure proper charging, and only maintenance required is occasional dusting.

SIMPLE TO OPERATE, portable and compact, describe new G-E single-circuit, universal-type chargers. A few adjustments permit charging many sizes of nickel-alkaline and lead-acid batteries. Protection and automatic control are built in.



FOR LARGE FLEET OPERATORS, multiple-circuit charging equipment like this is tailored to exact needs. This installation is designed to charge 24 sets of 30-cell, 1500-amp-hr batteries. To save space, only the control panel need be located in the charging area. For some large plants it is desirable to locate several smaller rotating chargers throughout the plant.

battery-charger selection

Builders of battery chargers for every use, G.E. helps you with impartial advice on the best types for *your* needs

No one battery charger is right for every job. That's why General Electric builds a ***complete line*** of rotating and rectifier units. And because we do, you can rely on the recommendations of your G-E representative or equipment supplier as sound and impartial.

This application help is based on a thorough study of your particular requirements. Here are three important ways you benefit: (1) you get equipment that will do the job dependably and economically, (2) you are assured of not buying more elaborate equipment than you need, and (3) you receive advice and suggestions for making the most efficient use of the battery-charging equipment selected.

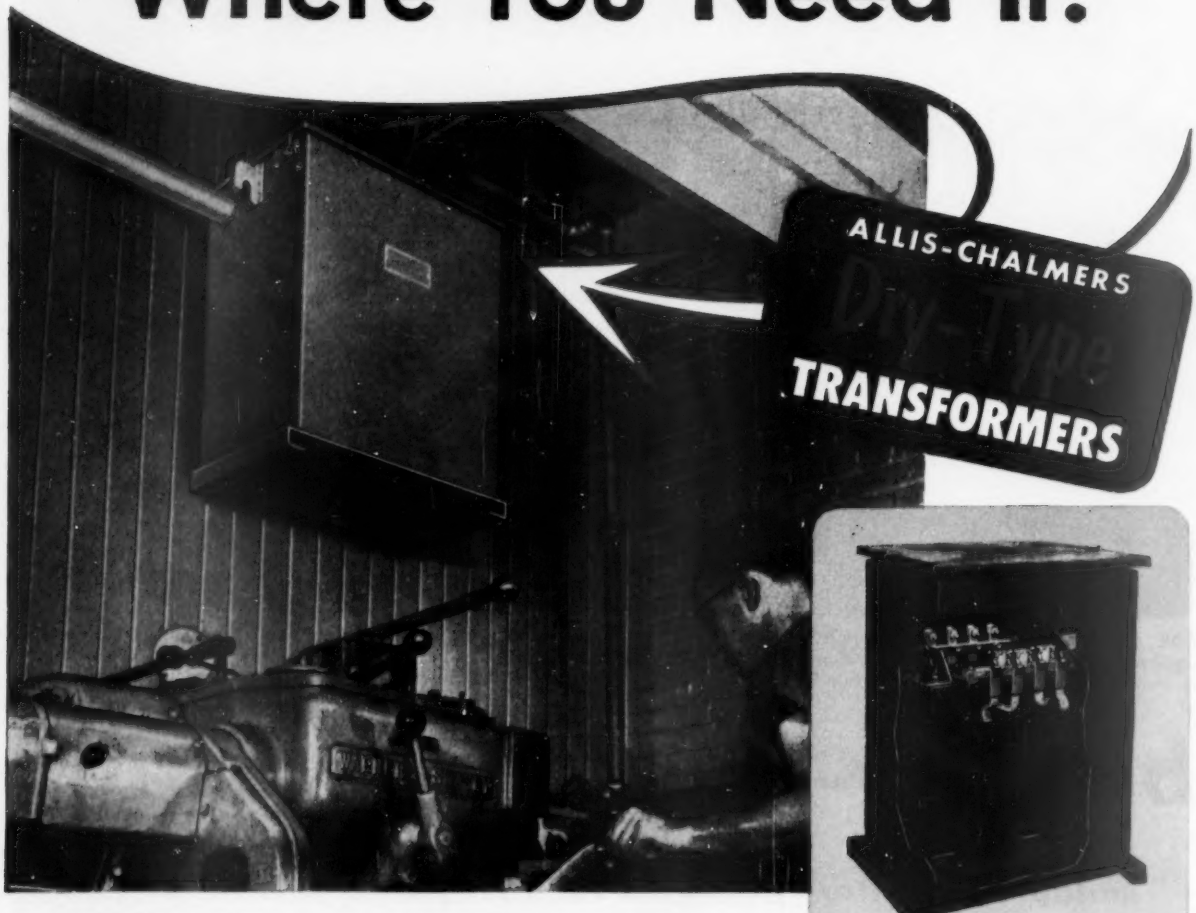
Whether you operate a few electric trucks or a large fleet, your G-E representative or equipment supplier offers you the most for your charger dollar: a complete selection of top quality equipment plus sound application advice based on years of experience. Be sure to contact him when making plans for new charging equipment. General Electric Co., Schenectady 5, N. Y. 669-4

ENGINEERED ELECTRICAL SYSTEMS FOR MATERIALS HANDLING

Conveyor drives • Crane drives • Hoist drives • Industrial truck drives and battery chargers

GENERAL ELECTRIC

PUT POWER Where You Need It!



HERE'S THE WAY to assure rated voltage for motors and other equipment. Install Allis-Chalmers dry-type transformers close to the load to provide full voltage for efficient motor operation, flicker-free lights, and full heating of thermal equipment.

You can mount them anywhere, on posts, beams or walls, in a small amount of space, or right on the machine itself. You don't need vaults or expensive enclosures.

Installation is easy because junction boxes are eliminated. Knockouts are provided for connecting conduits directly to the transformer case. System cables are connected to the transformer terminals in compartments.

Maintenance is easy, too. You install Allis-Chalmers transformers and forget them except for periodic inspections. There are no insulating liquids to maintain; no gauges or gaskets to fuss with.

Get more information from your Allis-Chalmers district office, or write Allis-Chalmers, Milwaukee 1, Wis.

A-3980

IT'S ENDURANCE BUILT

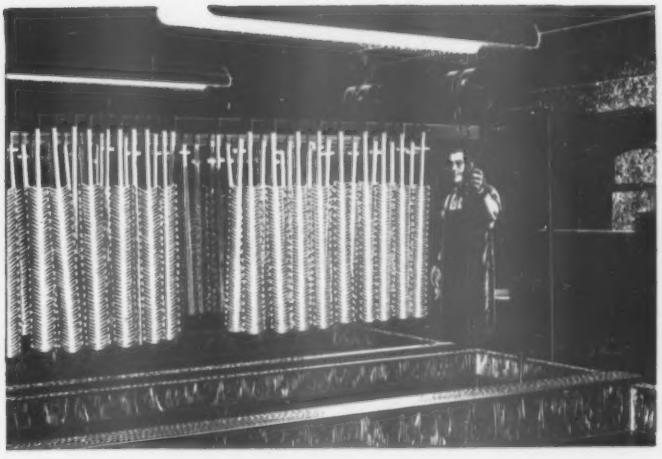
Core and coil assembly is impregnated to guard against moisture and dirt. All-welded, modern looking case protects the internal assembly. Case is Spra-Bonderized to protect it against corrosion. Three coats of baked-on alkyd resinous paint furnish additional protection.

Ratings 167 kva and smaller (single phase); 300 kva and smaller (three phase); 600 volts and below.

ALLIS-CHALMERS

Servel

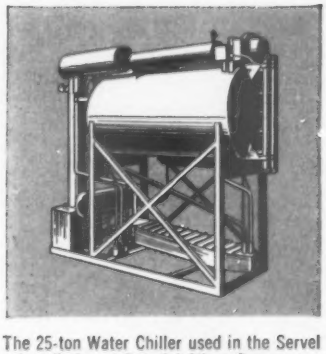
WELCOMES...and SOLVES



tough industrial cooling problems

When Colonial Alloys Company of Philadelphia decided to anodize aluminum products by the new and different Electrodizing Conservation or "EC" process, it faced the problem of maintaining proper temperature of the electrolytic bath solution.

To meet this essential requirement, Colonial Alloys chose a Servel 25-ton Water Chiller. Not only does this single Servel Air Conditioning unit maintain constant, controlled solution temperature, but it also provides office air conditioning, chilled water for experimental work, and cold drinking water.



The 25-ton Water Chiller used in the Servel installation at Colonial Alloys Company.

Colonial Alloys reports that the new "EC" process, in which Servel equipment plays such a leading part, has *increased aluminum anodizing production as much as five times, while cutting costs as much as 99%!*

This is one of many examples of how Servel Air Conditioning equipment benefits industry. Chances are, your problem can be solved in an equally satisfactory manner. Because Servel Air Conditioning *uses heat to produce cold*, operating economy is outstanding. It operates on gas, oil, steam or waste heat—whichever is the most economical fuel in your area. There are *no moving parts* to wear or cause vibration. And every Servel unit carries a complete *five-year warranty.*

★ ★ ★

Servel manufactures the world's finest air conditioning equipment to fit all air conditioning needs—residential, industrial, commercial—all-year or cooling alone. For complete information, clip and mail the coupon today.

Servel

the name to watch for great advances in—

AIR CONDITIONING ✓ REFRIGERATION

SERVEL, INC., DEPT. FM-3 Evansville 20, Indiana

I want to know more about industrial uses of Servel Air Conditioning.

Name _____

Title _____

Company Name _____

Address _____

City _____ State _____

INSIDE AN EXIDE-IRONCLAD

Inside . . . where it counts most . . . EXIDE-IRONCLAD is entirely different than any other battery. It's made that way by EXIDE'S exclusive IRONCLAD slotted-tube construction . . . a principle that provides direct operating-hour savings for you.

OF ALL BATTERIES, ONLY EXIDE-IRONCLADS HAVE POWER TUBE POSITIVES

The positive plate is different . . . unique . . . exclusive. It is the most effective retainer of active material yet demonstrated in heavy duty service. Slotted tubes contain the active material. So fine are the slots that, while permitting easy access of electrolyte, they retard the active material from washing out, hold it during repeated cycles of charge-discharge, and the vibration of rough use.

Today's battery-powered equipment is being used harder than ever before. Unless the batteries have internal shock protection they tend to deteriorate under hard usage—both electrical and mechanical. Only Exide-Ironclad has the plus-protection of the tubular positive that can withstand today's more exacting and rigorous heavy-duty battery services.

Your EXIDE sales engineer will give you the factual inside story. See for yourself why *only* an EXIDE-IRONCLAD gives maximum day-after-day service under the most difficult operating conditions . . . *with a minimum of maintenance expense.*

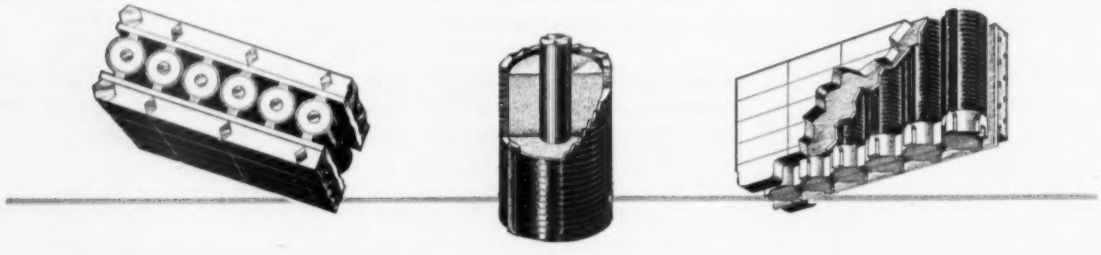
THE ELECTRIC STORAGE BATTERY CO.
Philadelphia 2
Exide Batteries of Canada, Limited, Toronto

1888 . . . DEPENDABLE BATTERIES FOR 65 YEARS . . . 1953

Cross section shows relation of positive plate to separators and negative plate. Note the much greater exposure of active material to electrolyte as compared with that of the usual flat positive plate. This greater exposure makes possible the high power ability and uniform-voltage characteristics of the Exide-Ironclad. The negative plates have been made extra heavy to balance the increased capacity of the power tube positives.

Running through center of each tube is an alloy core which is cast with the heavy top cross bar. These form the sturdy, non-buckling grid. Both core and top bar are made of Exide's new corrosion-resistant Silvium, an alloy of silver, lead and other components, which adds greatly to plate's long life.

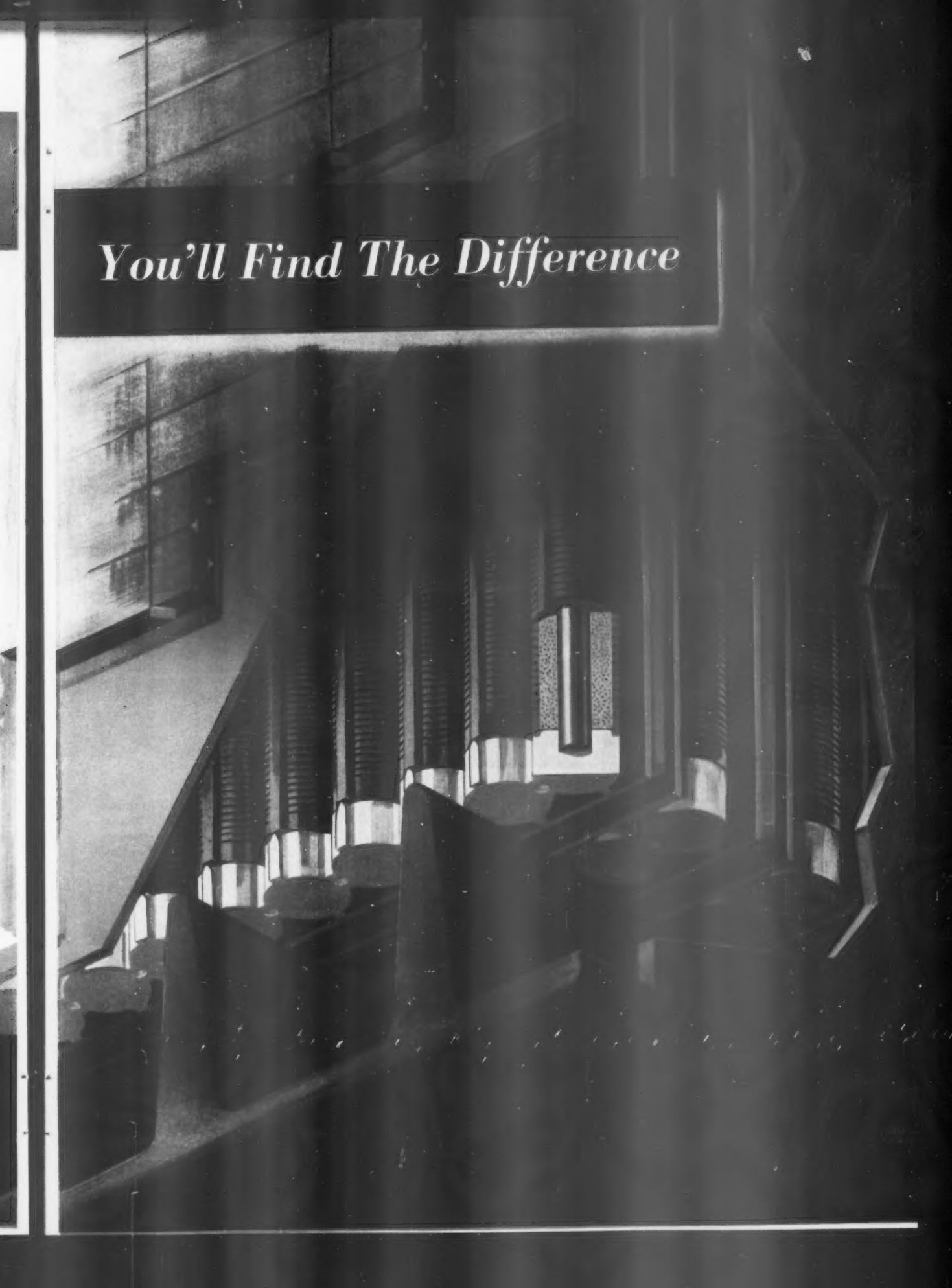
New polyethylene insulating tube sealer of acid-proof, non-corroding plastic fits snugly into bottom of slotted tubes and further reduces loss of active material. Thus more active material remains available, and the high battery capacity is maintained for a longer working life.



Exide-Ironclad

YOUR BEST POWER BUY . . . AT ANY PRICE

"Exide-Ironclad" and "Silvium" *Reg. T.M. U.S. Pat. Off.*


You'll Find The Difference

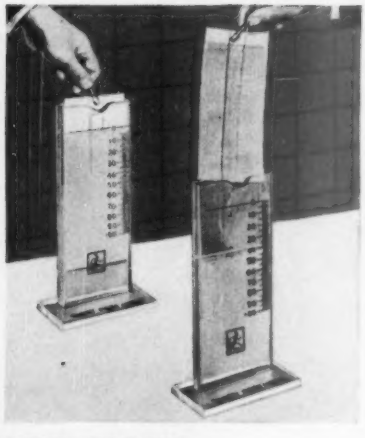
ScotTissue Towels save more because they do more

SAVE UPKEEP!
ScotTissue Towels save storage space —reduce servicing of dispensers and receptacles because fewer are used per employee per day.

Maintenance accounts for 90% of washroom costs—lower this expense by using ScotTissue Towels

SAVE TOWELS!
One ScotTissue Towel dries both hands — quickly — comfortably — thoroughly. Employees appreciate the extra strength and softness of ScotTissue Towels.

SAVE TIME!
Since one ScotTissue Towel dries both hands quickly, there are less washroom "traffic jams." Workers are able to get back to their jobs a lot faster.



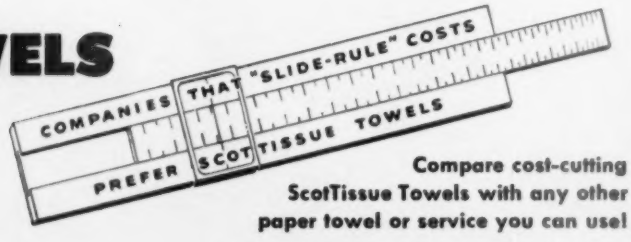
HERE'S PROOF!
Ask your Scott distributor to show you the "Thirsty Fibre" Meter Test—the amazing demonstration that proves ScotTissue Towels' greater value.

The right kind of washroom is one of the four most important essentials in good working conditions—according to a survey of employees from 400 plants.

Take advantage of our unique Washroom Advisory Service. We'd be glad to give you tested plans and specific suggestions for improving your washrooms. And if you would like a personal demonstration of cost-cutting ScotTissue Towels—the "Thirsty Fibre" Test—just write us on your company's letterhead. Address: Washroom Advisory Service, Scott Paper Company, Chester, Pa.

SCOTTISSUE TOWELS

Symbol of the right kind of washroom



Compare cost-cutting ScotTissue Towels with any other paper towel or service you can use!

"ScotTissue," "Thirsty Fibre," "Washroom Advisory Service," Reg. U. S. Pat. Off.

Which Square D Control Center will do *Your* job best?

1. STANDARD
2. BACK-TO-BACK
3. DUST-TIGHT
4. WEATHER-PROOF
5. FILTERED AIR

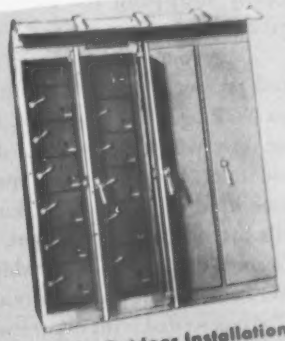
1 Standard Square D Plug-in Control Centers in Nema I enclosures are designed for the majority of installations.

SQUARE D FOR FLEXIBILITY! Square D's plug-in units can be removed, added, or exchanged at will. Both fusible switch and circuit breaker types available. Standardized sections and units are 100% re-usable after plant conversions or rearrangements.

Write for Bulletin 8938. Address Square D Company, 4041 North Richards Street, Milwaukee 12, Wisconsin.

2 Space an Important Factor? Back-to-back Nema I enclosures provide maximum concentration of control in limited space.

3 for Excessively Dusty Locations—felt-gasketed, dust-tight, Nema V enclosure. A "natural" for foundries, smelting and refining plants.



4 for Outdoor Installations—rubber-gasketed, Nema III enclosure protects equipment from weather. Special rust-proof, vinyl-clad finish.

5 Need Filtered Air Protection? Built-in fan and filter combination pressurizes enclosure for moderately dusty or certain types of corrosive atmospheres.

ASK YOUR ELECTRICAL DISTRIBUTOR FOR SQUARE D PRODUCTS

SQUARE D COMPANY

1903 · 50 YEARS OF DESIGN LEADERSHIP · 1953

Don't Bargain-Shop for Service . . .

Bargain shopping for electrical service can be expensive. You'll *lose* . . . if your apparatus isn't repaired properly . . . if the job has to go back to the repair shop. Real savings come only when the work is done right the first time. And this takes special skill—the same kind of engineering know-how that built the original equipment.

You can be *sure* of this craftsmanship at Westinghouse, in its 36 Repair Plants over the country. Each is staffed with experienced workmen who are specialists at rebuilding electrical equipment. They follow standardized procedures on every job. They apply factory-proved techniques and materials. They are backed by exhaustive tests that check out *all* work before the one-year guarantee on rebuilt apparatus is issued. This is the same guarantee carried by new equipment.

Complete service protection, however, calls for more than shop repair. It calls also for precision-built renewal parts, stocked in convenient locations . . . and factory-guided field service to make inspections, adjustments and on-the-spot repairs for equipment that cannot be moved easily.

That's why Westinghouse operates a nationwide network of maintenance services: 36 Repair Plants . . . 31 Renewal Parts Warehouses . . . 46 Field Service Offices.

CALL WESTINGHOUSE FOR A COMPLETE MAINTENANCE SERVICE

Repairs have to be engineered, too!

Combined, these provide a *complete* maintenance service—backed by factory-tested methods, factory-approved materials, factory-trained specialists. They offer the finest in *service protection* . . . the best in *service economy.* Your proof is in the performance of the finished job.

For more information, write today for a free copy of Westinghouse Maintenance booklet, B-4766. It's loaded with facts and illustrations covering the complete Westinghouse Maintenance Service. Send your request to: Maintenance Sales Dept., Westinghouse Electric Corp., East Pittsburgh, Pa. J-95158

...MATCHED TO YOUR NEEDS

YOU CAN BE **SURE**...IF IT'S

Westinghouse

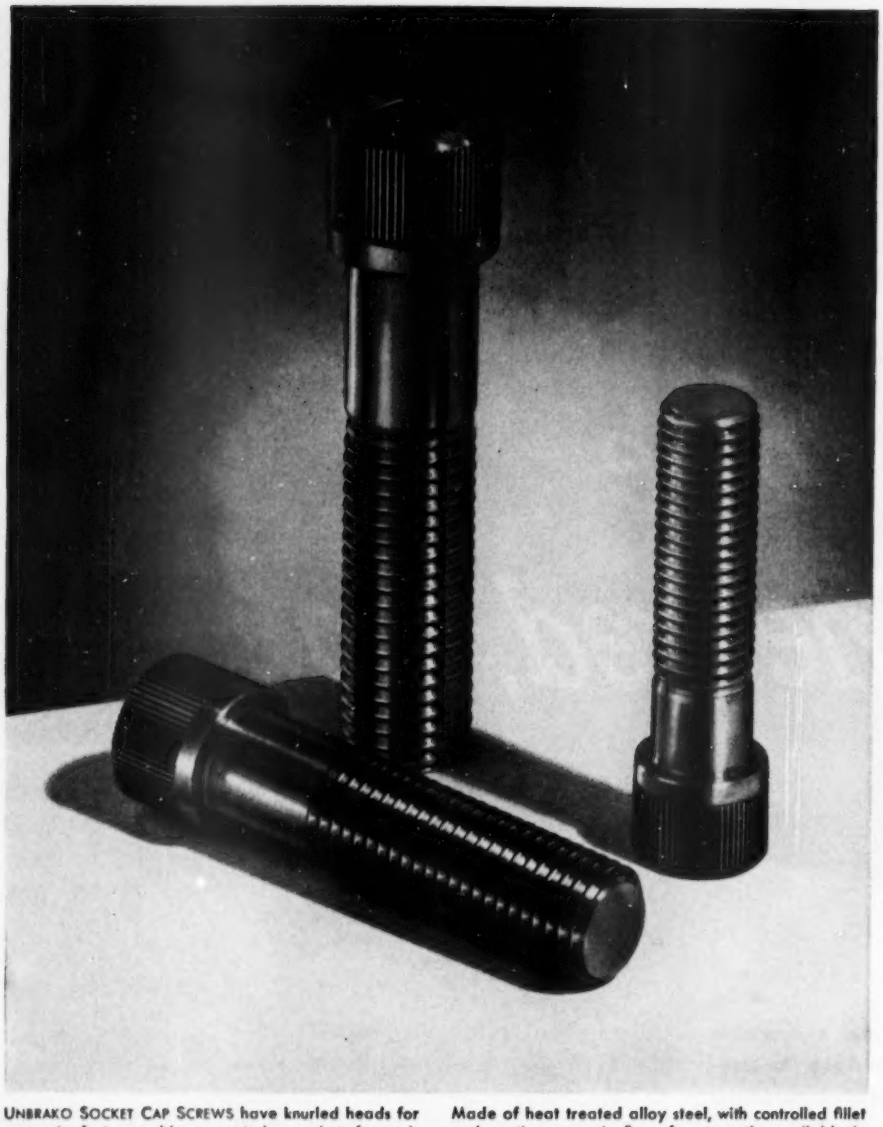
COMPLETE MAINTENANCE SERVICE

SHOP REPAIR FIELD SERVICE

GENUINE RENEWAL PARTS

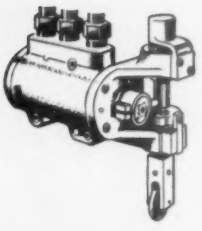
Our Fiftieth Year

A START FOR THE FUTURE

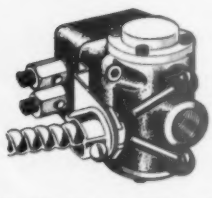


UNBRAKO SOCKET CAP SCREWS have knurled heads for sure grip, fast assembly; accurate hex sockets for positive, internal wrenching; fully formed threads, Class 3 fit.

Made of heat treated alloy steel, with controlled fillet and continuous grain flow, for strength; available in standard sizes from #4 to 1" in a full range of lengths.



USE UNBRAKO SOCKET CAP SCREWS for compact designs to save space, weight and material on machine tools and metalworking equipment.



On electrical and electronic devices, textile machinery and automotive equipment.

On precision instruments, dies, jigs and fixtures, and many other applications too numerous to mention.

Do you really need a special UNBRAKO screw?

Before you specify a special socket screw, check UNBRAKO Standards. A standard UNBRAKO will do the job as well in most cases—and much cheaper. You'll get better service and faster deliveries, because UNBRAKO socket screw products are stocked by your industrial distributor. Write for UNBRAKO Standards. SPS, Jenkintown 11, Pa.

Write for UNBRAKO Standards

UNBRAKO® SOCKET SCREW DIVISION

SPS JENKINTOWN PENNSYLVANIA

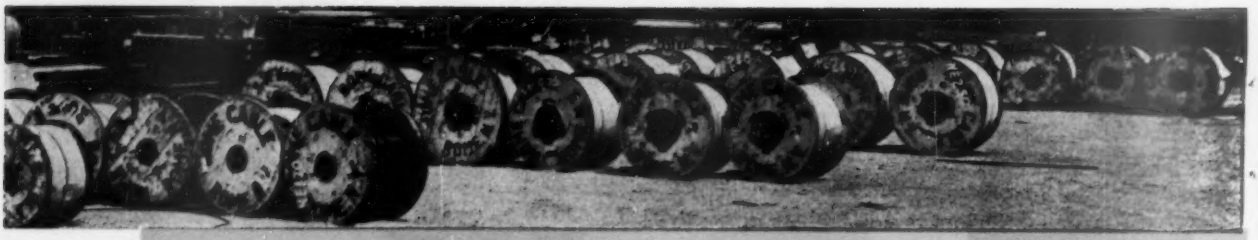
Pick out the tough spots on your production line . . . key spots where a breakdown means a costly shutdown. Then find out how the Coffing Quik-Lift's dependability really pays off. This hoist is a full-fledged production unit, built to stand up under hard assembly-line use. Its "tough spot" performance will soon repay its cost many times over in down time saved. So do as many others have done. Start the Quik-Lift on a hoist assignment where others have failed — then standardize on Coffing after it has proved its value the hard way.

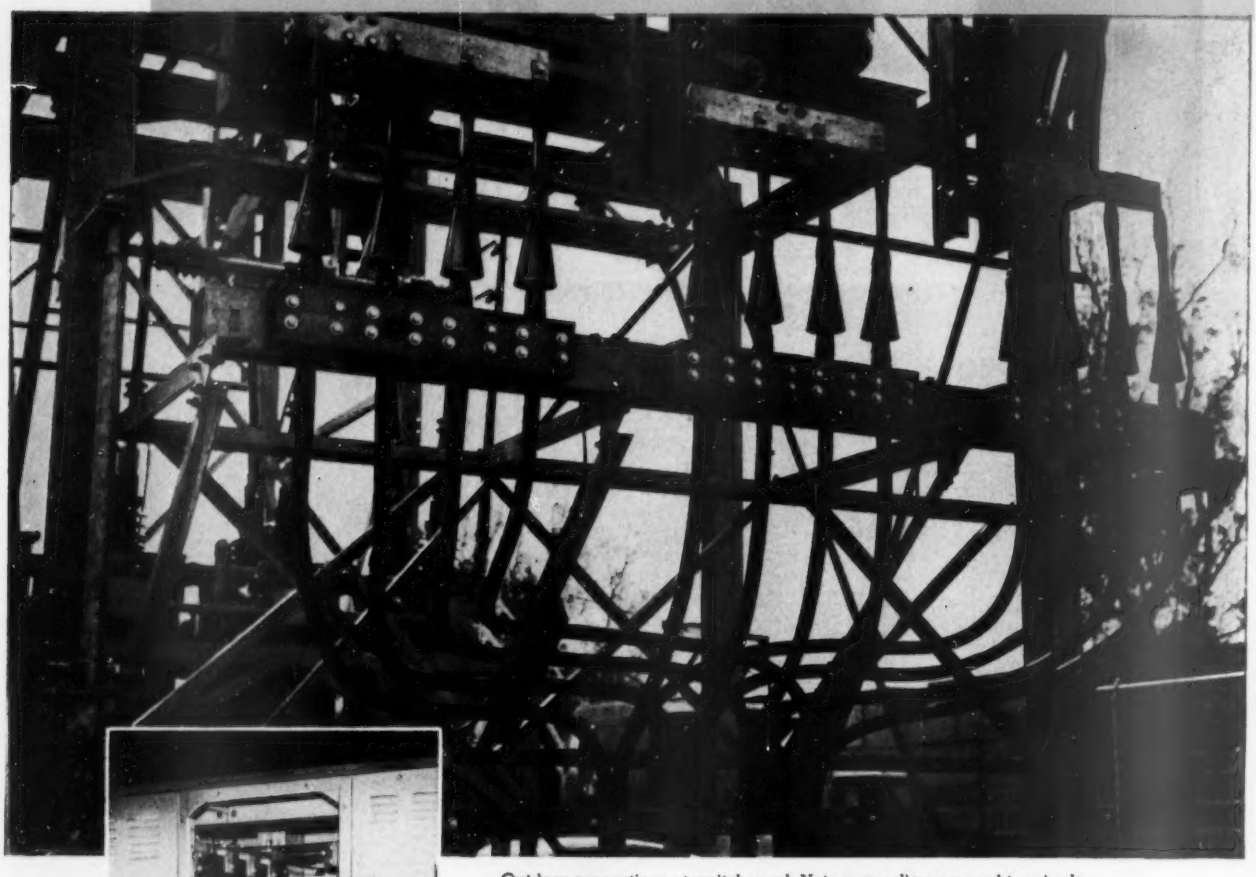
For more information on Quik-Lift Electric Hoists, write for Bulletin M3E.

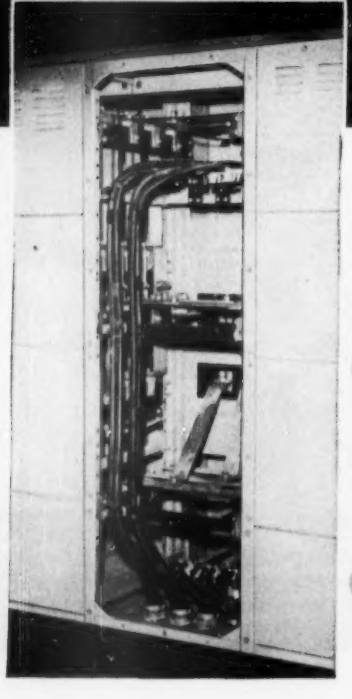
COFFING HOIST COMPANY
Danville, Illinois

sold by distributors everywhere

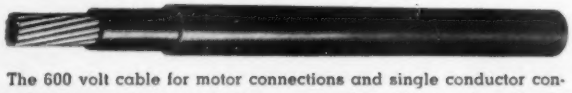
Hoist-Alls • Safety-Pull Ratchet Lever Hoists
Mighty-Midget Pullers • Spur-Gear Hoists
Differential Chain Hoists • Load Binders
I-Beam Trolleys







Outdoor connections at switch yard. Note manually prepared terminals.



The 600 volt cable for motor connections and single conductor control cable was RoMarine-RoPrene, style RR-D. All sizes from No. 12 to 1000 CM style RR-D were used for this service.

Multi-conductor control cable in this installation is RoLene (polyethylene) insulated and Rome Synthinol sheathed, described by Rome Cable specification CT-2.

Recently built Kaiser Steel Tin Plate Mill (left foreground), Fontana, California. Capacity is 200,000 tons of tin plate per year.

Electrical Contractor: Kaiser Engineers, Inc.

How Kaiser Steel licked 3 tough cable problems all at once

In selecting power cables for 6.9 KV circuits at its new Fontana Tin Plate Mill, Kaiser Steel Corporation faced three knotty problems:

First, the hazard of acid and alkali corrosion was severe.

Second, the threat of electrolytic action was more than a possibility.

Third, termination and splicing costs were important factors.

Kaiser's choice for this service fell to single conductor, 500,000 CM Rome RoZone-RoPrene shielded power cable, insulated for 9 KV. Two sets were installed to connect the main substation with two 6,900 volt busses in the tin mill proper. Total connected load to the busses was 19,000 HP of M-G motors and 14,250 KVA of transformers.

Why RoZone-RoPrene

RoZone insulated, RoPrene sheathed cables offer maximum protection against acids, alkalies, oils, greases, moisture, heat, sunlight, and flame. They are non-metallic sheathed and require no lead sheaths with subsequent cathodic protection against electrolysis. Their RoZone (premium quality oil base) insulation provides exceptional resistance to corona action and ozone cutting.

Simple manual terminations eliminate the need for regular wiped potheads. Standard splicing kits only are needed; no costly wiped joints. And the smooth surface of the RoPrene (Neoprene compound) sheath makes for easy working and pulling through conduits and junction boxes.

HELPFUL INFORMATION—Whether your electrical requirements involve special cable designs to meet severe service conditions or simple home wiring, consider the advantages Rome products offer from the standpoint of price and quality. For information that you may find immediately useful, send for the *Rome Power and Control Cable Catalog* illustrated below.

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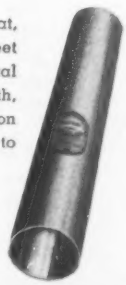

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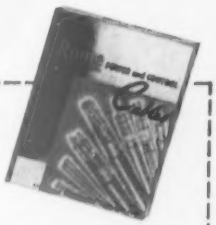

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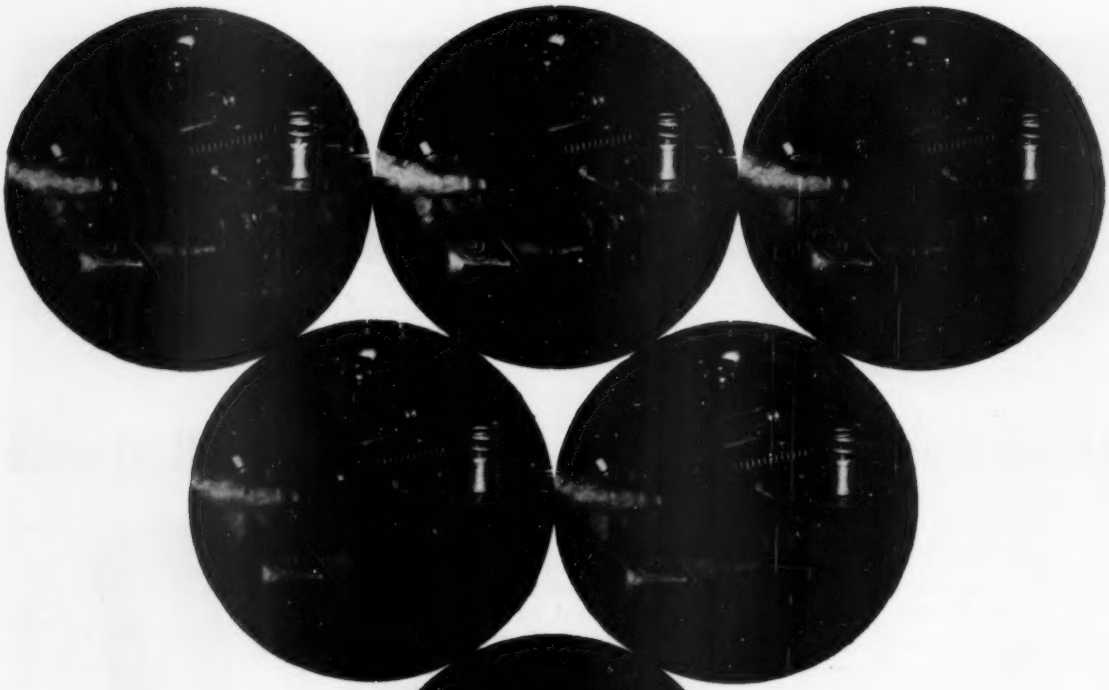

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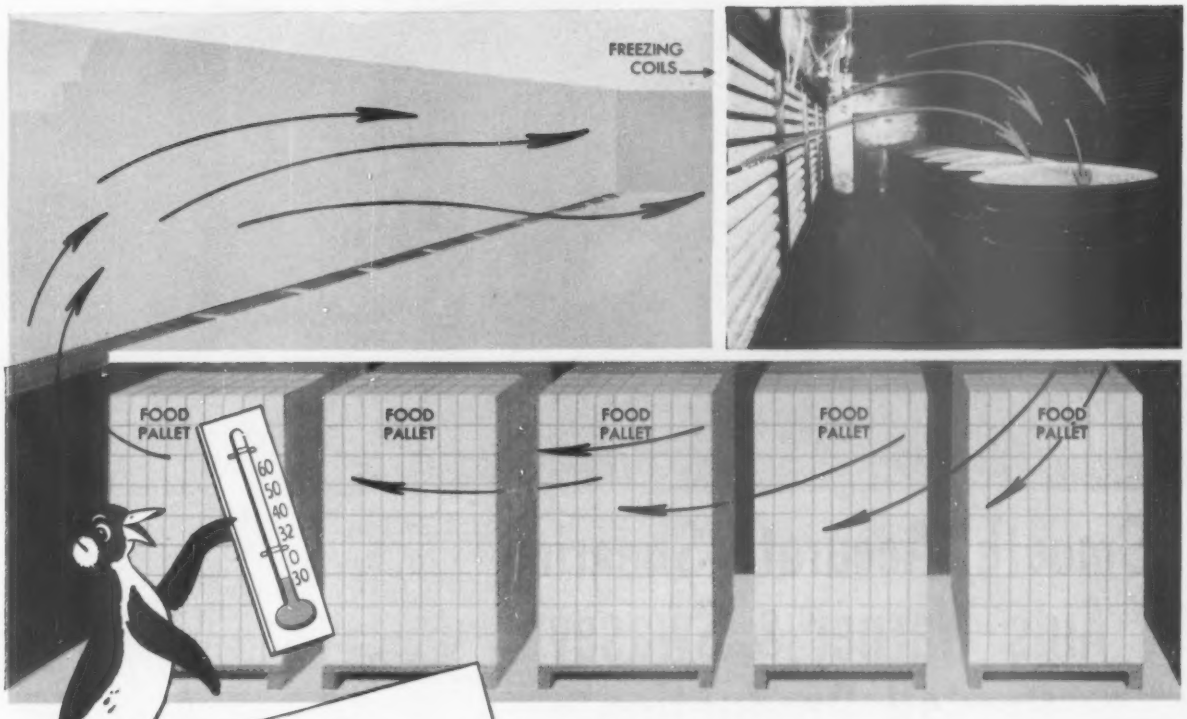


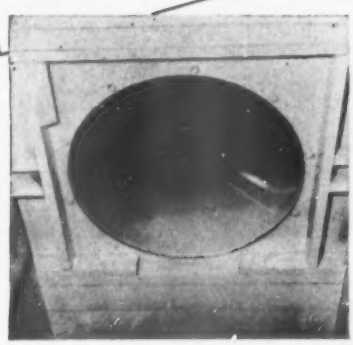
JOY AXIVANE® FANS HANDLE SEVERE QUICK-FREEZE JOB

A West Coast quick-freezing plant boasts an effective operation that utilizes 24 Joy 7½ HP Series 1000 Axivane Fans, installed in two groups of 12 each.

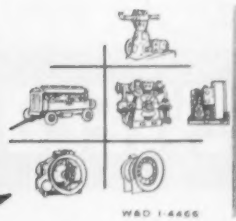
Note the illustration above. The upper floor contains freezing coils and a row of 12 fans. The floor below is partitioned into narrow freezing tunnels, each served independently by a single Joy fan.

As air passes through the freezing coils, it is cooled to between —30° and —35°. This sub-zero air is propelled down and through the tunnels below, which contain pallets of meat, vegetables, fruit, etc. to be quick-frozen. After passing over the food, the air is again cooled and circulated. At full plant load, each 12-fan battery handles 242,000 CFM of air.

The relatively quiet operation, light weight, compactness and low power consumption of Joy Axivane Fans—due to the unmatched efficiency of their vaneaxial design—have proved *real* advantages on this job. Their in-line construction also saves space, since each fan can be mounted right in its short, vertical duct. In addition, extreme flexibility of operation is made possible by the adjustable blades, a standard Joy feature. ● Let us help you to get best results on your fan problems. ***Joy Manufacturing Company, Oliver Bldg., Pittsburgh 22, Pa.*** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*



Left: Looking up from the quick-freeze room below a Joy Axivane Fan. Note the compact, economical use of space and the simple mounting.



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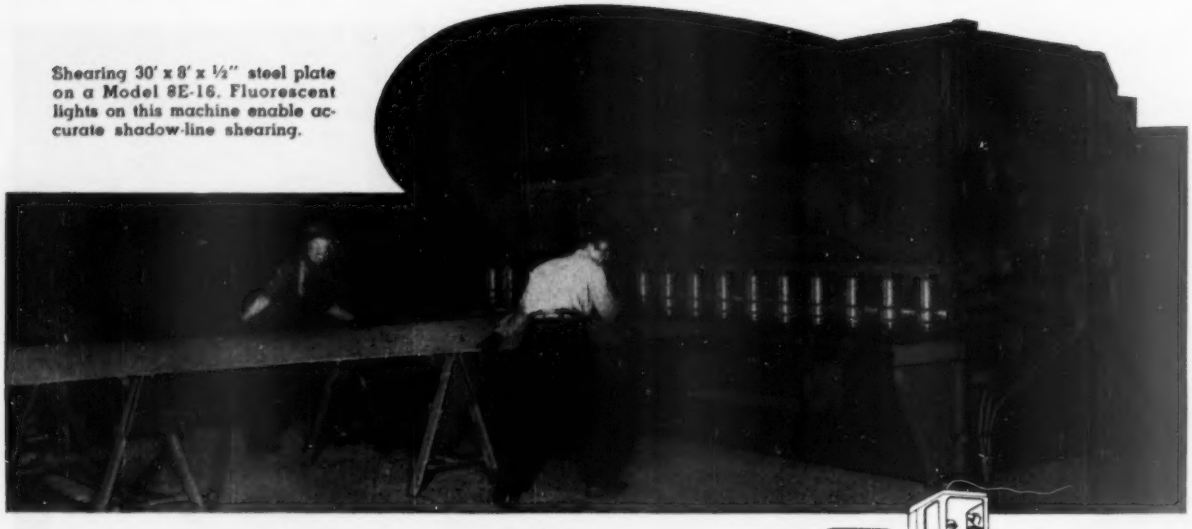
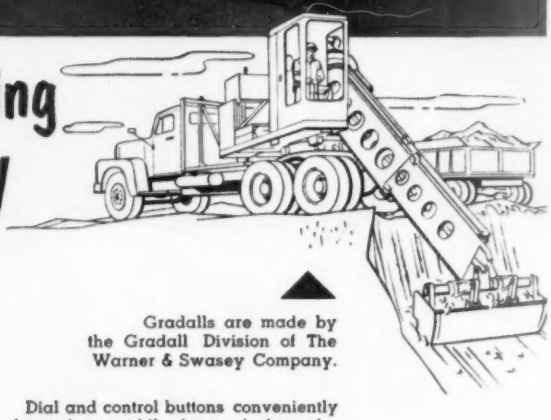


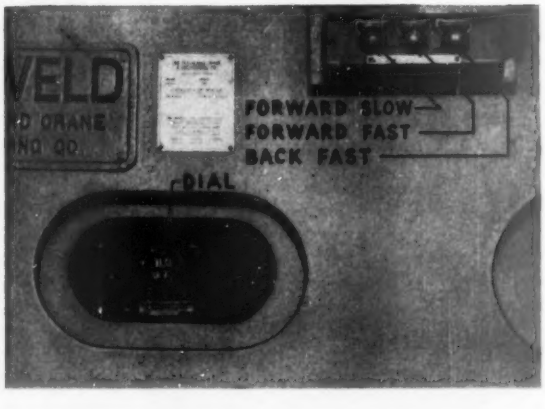
Shearing 30' x 8' x ½" steel plate on a Model 8E-16. Fluorescent lights on this machine enable accurate shadow-line shearing.

Smooth, Accurate Shearing Aids Warner & Swasey Gradall Production



Gradalls are made by the Gradall Division of The Warner & Swasey Company.

Dial and control buttons conveniently located at middle front of shear for setting motor-driven back gauge.



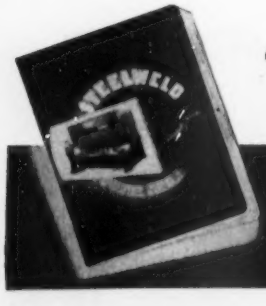
A Steelweld Pivoted-Blade Shear cuts all the plate used in the manufacture of Warner & Swasey's Gradall Multi-Purpose Earth-Moving Machines.

Because of the simple Micro-Set knife clearance adjustment it produces clean, sharp cuts to close tolerances in various thickness metals ranging from light gauge to ½".

The motor-driven back gauge is very popular with the operators because of the ease and speed with which it can be set. Simply by pushing buttons at the middle front of the machine and reading a dial which records to 1/64 inch, the gauge is quickly positioned exactly as required.

Steelweld Shears and Gradalls are alike in many respects: Heavy all-welded construction — Many new and revolutionary features — Entirely different in operating principle from other similar-purpose machines. Both speed the work and cut costs.

If you work with metal plate of any kind, you should have the facts on Steelweld Shears. A Steelweld representative will be glad to call on you at your convenience.



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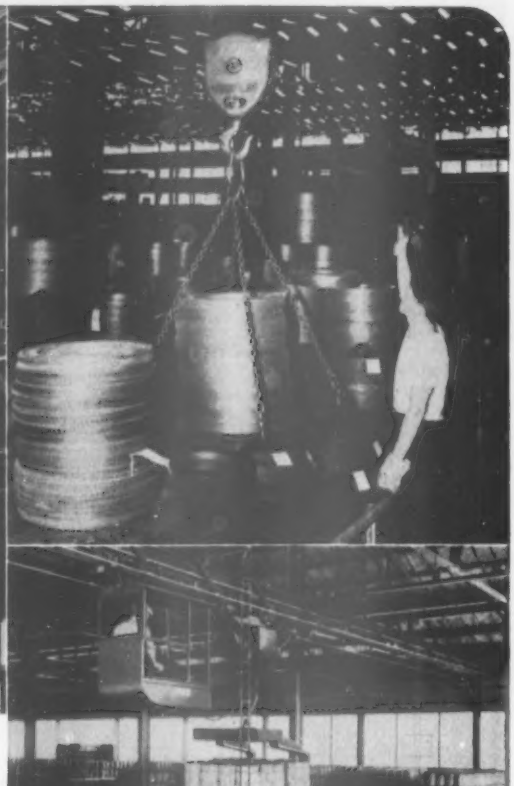
Store More—Eliminate Congestion—Cut Maintenance—Save Floors

Pallets loaded with motor stator laminations are easily lifted and moved with these floor-operated Tramrail cranes. Note that the entire area is jam-packed, with no lost aisle-way space. The ease with which any loaded pallet can be picked up and handled to awkward-to-reach places is a distinct advantage.



Pallets with 32 100-lb. kegs of nails are piled high in storage with the cab-operated Tramrail crane and open-side pallet lift.

THERE'S no height limit when stacking palleted materials with Tramrail cranes. 20 ft.—30 ft.—40 ft. or higher are easy. Your materials and building are the only limiting factors.

Often 50% and more materials on pallets can be stored in a room served by overhead cranes. Narrowing of some aisles, elimination of others, plus higher and closer piling make the difference.

Pallet loads are moved safely and speedily overhead where the path is always clear and unobstructed. Placing this handling job near the ceiling, reduces floor congestion and frees much of it for other purposes.

Maintenance costs for Tramrail cranes are extremely low, usually only a few percent of that for power-operated floor trucks. No engines to overhaul. No clutches to replace. No brakes to re-line. No batteries to charge. No irritating gas fumes. And of importance, extra heavily reinforced floors are not required and costly floor damage because of materials handling is eliminated.

When considering pallet handling or any materials handling, it will pay you to look into the tremendous advantages that Cleveland Tramrail cranes offer.

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CLEVELAND TRAMRAIL
OVERHEAD MATERIALS HANDLING EQUIPMENT

Friden *figures on* COOLITE

Exterior of new Friden Calculator plant, San Leandro, Calif., showing the extensive use of Coolite to provide ample daylight illumination. Architect, Frederick H. Reimers, San Francisco, Calif.

Calculator Manufacturer's New Plant Glazed with 8200 Sq. Ft. of Coolite Glass by Mississippi

Careful assembly operations build into each Friden Calculator the accuracy for which these machines are famous. To help achieve the best possible working conditions, Coolite Heat Absorbing and Glare Reducing Glass was specified in Friden's new plant at San Leandro, California.

Coolite filters out unwanted factors in raw sunlight and helps keep plant interiors cooler and more comfortable. Workers see better, feel better, work better under softly tinted, filtered daylight. Coolite helps fight eye fatigue, boosts employee morale.

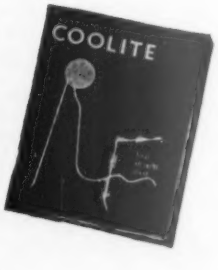
SEE HOW YOU CAN PROFIT WITH COOLITE

This amazing "visioneered" glass by Mississippi helps production, reduces rejects. If you are planning new industrial construction or modernizing existing facilities, it will pay you to find out how Coolite can provide increased efficiency and economy. See your nearby Mississippi Glass distributor today.

Assembly workers find daylight, diffused and tinted by Coolite is more comfortable. Copious illumination eliminates shadows, helps make seeing more accurate.

Translucent, light diffusing figured and wired glass by Mississippi for better daylight illumination is available in a wide variety of patterns and surface finishes, all scientifically designed to distribute light to best advantage.

Send for free Coolite catalog, "Coolite Heat Absorbing and Glare Reducing Glass." Samples on request.



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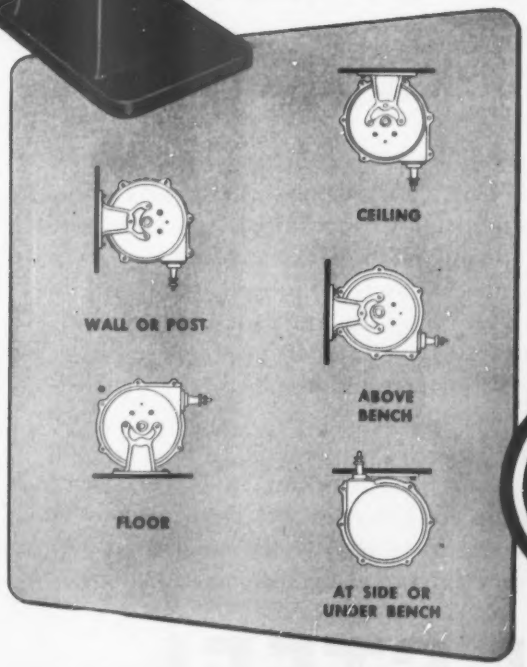

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LOOKING AHEAD IN LABOR

Last-minute round-up as we go to press

Lifting of wage-salary controls on February 6 will have little immediate impact on wage negotiations. The 1953 wage picture won't come into focus for most employers until July. That's when Big Steel must settle with CIO.

Until summer, labor leaders will be busy with other matters: Taft-Hartley revision, civil rights, unity talks, Labor Department organization. Any bargaining will be strictly spring training for summer and fall showdowns in steel, copper mining, electrical, coal, aircraft, and railroad industries.

•

Labor's outlook for big wage increases is not good at this time. Much will depend on what happens to prices. And profits. Right now the cost of living is not rising. It's still below last June. Labor economists pin hopes for raises on increased productivity and higher profits.

No matter what, though, wages will still tend upward. For many reasons, not all valid economically. The recent trend can't be stopped abruptly—not with a million auto workers getting a productivity boost in June. Nor psychologically, after lifting wage "ceilings." Or politically. Failure to get raises in 1953—with business good — would surely turn many workers against Republicans.

Watch for union shifts away from cost-of-living escalators. That's natural when prices get sticky or turn downward. AFL's machinists' union has passed this word to locals: "Ditch the escalator if you can; get a six-month wage reopening instead." Walter Reuther would like to junk his auto escalators before 1955. He'll hear about this at UAW-CIO convention this month. Railroad unions won't renew their three-year escalator this fall.

•

Other union trends: Machinists' union wants locals to get together, where possible, and make contracts with groups of employers—even with more than one employers' association.

At Toledo, UAW-CIO's city-wide Local 12 has begun handling solicitations for Community Chest and other charities. Members at Willys-Overland give 25 cents each week to Local 12. Local then allocates to various charities. Thus union might have more to say about how the charity is run.

Taft-Hartley revision is taking even longer than expected. Nobody seems to be in any real hurry to do anything about it. House hearings will run through April. Senate Committee is waiting until President Eisenhower sends up his proposals before even beginning. There's growing talk that nothing will be done this year.

Behind the delay: Attempt at both ends of Pennsylvania Avenue to get substantial agreement on amendments. Eisenhower won't make up his mind until he studies recommendations of the new Labor Department advisory committee (labor, management, and public) and his Secretary of Labor, Martin P. Durkin. He will also tap other sources in and out of the Cabinet and White House staff.

Meanwhile, Senators H. Alexander Smith and Taft hold private talks with top labor and industry leaders, trying to narrow down their differences. They will run the hearings, with Taft also carrying the ball on the Senate floor.

We don't look for amendments before Taft-Hartley's sixth birthday, June 27, if then.

•

Long-term labor contracts will be protected by NLRB against raiding—if they are common in the industry. Reason: labor stability. The Board refused to open five-year agreements in automobile industry to challenge by craft unions. Before, NLRB would not back up any contract that ran for more than three years.

Other industries will benefit from the decision. Those in which at least a third of the contracts run for three or more years: apparel, machinery, services, fabricated metals, construction, and electrical products.

Stewart-Warner Corporation has — finally — won its fight to have AFL electricians represent its workers. More than three years ago, Stewart-Warner fired employees, for security reasons, who would not sign non-communist affidavit. It kicked out the left-wing UE, signed up with IBEW-AFL. CIO came into the picture, lost an election. Company fought NLRB unfair practice findings in the courts, and won. Now NLRB has thrown out CIO objections that Stewart-Warner helped IBEW win the election. IBEW is in, to stay.

SEE PRACTICAL LABOR RELATIONS, PAGE 262

LOOKING AHEAD IN BUSINESS

Last-minute round-up as we go to press

The removal of price controls will have little effect on raw material costs in factories. Wholesale prices of industrial materials have been dropping steadily for two years. In the eight months following the outbreak of the Korean War, average prices went up 57%. Now they have plunked back down to their pre-Korean level.

As one economist, Arthur Upgren of the University of Minnesota, put it: "DiSalle and the Office of Price Stabilization could just as well have been off in the Fiji Islands for all the effect they had on the price level." This may be putting it a little strong. But it is true that price controls did not get under way until early 1951, and by then wholesale prices had started down. Supply and demand forces, not OPS, have been in control of most prices for two years.

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In fairness, there have been a few strategic materials whose prices have been held down by price controls. During early 1951 most metals and some chemicals, like sulfur, were scarce enough so their prices might have gone up slightly without price control. But not enough to keep the average of wholesale prices from dropping.

Today only a handful of industrial materials are likely to rise in price with the end of controls. Copper prices have already gone up some. Prices of nickel and some of the new metals like columbium will probably rise. Some types of finished steel and aluminum could go up a little because of the high demand for these materials in the next two or three months.

The supply of steel and aluminum is catching up to demand closely enough so that price-raising now would hurt the competitive position later. Aluminum producers are anxious to expand their market by introducing new uses of aluminum in place of other metals. Raising prices would hinder this process. In short, price rises for materials will be the exception rather than the rule.

•

Finished goods are more likely to go up in price than industrial materials. But rises will be small and short-lived. The cause of strengthening prices in finished goods is an increase in speculative activity and inventory building.

Inventories were built up at a rate of $5-billion a year in the last quarter of 1952. The rate of inventory building now seems to have stepped up to about $7-billion a year. Such a high rate of inventory building is likely to cause a letdown in business later. In the meantime, orders for some finished goods are pressing enough to encourage a few price increases.

•

One of the curiosities of today's economic scene is that businessmen seem to be jittery about inventories. Yet they go right ahead and pile them up. The explanation seems to be that businessmen, sensing a tighter selling situation ahead, are trying to out-produce and out-compete one another. In order to capture a larger share of the market, the businessman must have a large inventory. Otherwise he will not have the stock from which to deliver goods when sales are made. In other words, businessmen are taking a calculated risk that, although someone may get hurt in the coming scramble for business, they themselves won't.

If this accurately represents the psychology of businessmen today, it means they feel that the long-term outlook for their business is good. It is good enough to run the risk of a temporary inventory glut in order to get a stronger hold on the competitive markets of the future. Businessmen are beginning to flex their muscles.

•

The key to success in such a situation is high productivity. The firm that can keep driving up its output per man-hour, which results in lowering unit costs, clearly is best equipped to survive this kind of competition. The majority of business firms must either feel themselves to be big enough, financially strong enough, or efficient enough to maintain the present rates of production and inventory building. Obviously, they cannot all be right, unless consumer spending expands phenomenally in the next few months. This seems a little unlikely in the face of falling farm incomes, tapering of defense spending, and levelling off of activity in capital goods industries.

An inventory letdown of modest proportion, therefore, seems to be coming later this year. The best preparation for this situation is a firm grip on stocks and a real drive for productivity gains.

ANNOUNCING
THE NEW
LUNKENHEIMER
VALVE
HANDWHEEL

"non-slip"*
for
positive closing

This revolutionary "Non-Slip" Handwheel introduces another Lunkenheimer improvement! Four rounded, non-slip lugs are gripped comfortably and firmly — operator's hand can't slip, even when wet or greasy. Result: Ordinary hand leverage closes the valve tight.

The new "Non-Slip" Handwheel is cooler, too—and keeps the operator's hand away from the top of the stem, which may be hot. It's sturdier, easier to operate, and makes your valves last longer.

*Patent Pending

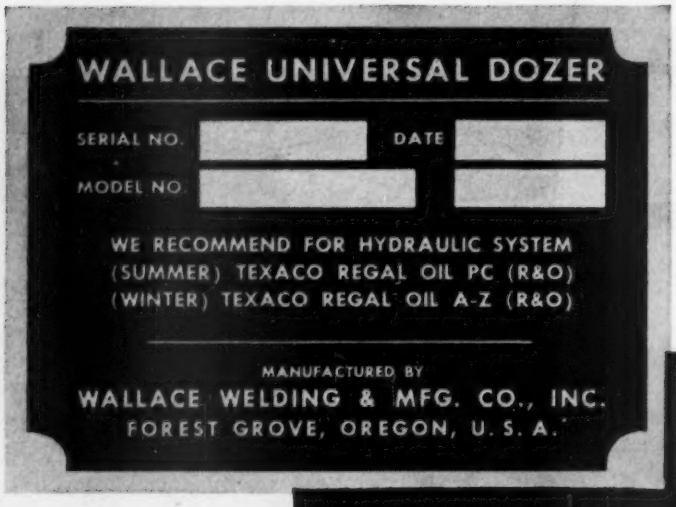
WRITE FOR the name of your nearest Lunkenheimer distributor. He can show you samples of Lunkenheimer Valves with the new "Non-Slip" Handwheel. See them for yourself — *test them*. The Lunkenheimer Company, Box 3601., Cincinnati 14, Ohio.

BRONZE • IRON • STEEL

LUNKENHEIMER

THE ONE *Great* NAME IN VALVES

L-152-29



THIS PLATE GOES ON EVERY UNIT WE MAKE"...

—says Jim Robertson, Superintendent, Wallace Welding & Machine Works, Forest Grove, Oregon

Wallace Welding & Machine Works makes hydraulic equipment — principally for use in the operation of bulldozers and tractors. "There is no doubt in my mind," says Mr. Robertson, "that the owner of any hydraulic equipment should use a rust- and oxidation-inhibited oil. If you've ever seen hydraulic oil pumps and controls dirty, rusty and varnished up by cheap ordinary oils you know what I'm talking about.

"On the other hand," Mr. Robertson goes on, "I have yet to see one of our units in which *Texaco Regal Oil (R&O)* has been used that wasn't clean, free from rust and sludge — with pump parts, piping, controls all in A-1 condition. We want our customers satisfied with our equipment. That's why we put a plate on every unit we make recommending the use of *Texaco Regal Oil (R&O)*."

Texaco Regal Oil (R&O) is turbine-quality oil that tests prove has ***more than ten times the oxidation resistance*** of ordinary turbine-quality hydraulic oil — plus improved rust-preventive properties. It is specially processed to prevent foaming.

There is a complete line of *Texaco Regal Oils (R&O)* approved by leading hydraulic manufacturers. A Texaco Lubrication Engineer will gladly help you select the proper one for your equipment. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

TEXACO Regal Oils (R&O)
FOR ALL HYDRAULIC UNITS

TUNE IN . . . TEXACO STAR THEATER starring MILTON BERLE, on television Tuesday nights. METROPOLITAN OPERA radio broadcasts Saturday afternoons.

Are We Doing Enough Small-Scale Research?

WE ARE GETTING INTO a bad habit these days. We all hear about the colossal research jobs going on in industry. We read about the elaborate mass attack by the government and large companies on such problems as the H-bomb and guided missiles. We get a few hints of the possible impact of these developments throughout industry. And we are likely to jump to the conclusion that, if we can't do our research and development on this scale, we might as well forget it.

A significant report just issued by the Research & Development Board of the Department of Defense shows the basis for such thinking.

The report was prepared for the Board by the Bureau of Labor Statistics on the basis of a nationwide survey made in mid-1952. Nearly 2000 concerns returned usable questionnaires. They included almost all companies with large research programs. The government believes about 85% of the industrial research and development done in 1951 was covered.

Here are some of the most arresting features of the report:

- **"The national outlay for scientific research and** development totaled more than $3½-billion in 1952, over four times the yearly expenditure at the beginning of World War II. Two-thirds of this tremendous sum was for work performed in laboratories and other facilities owned or operated by private industry."
- **Federal government agencies financed** close to half of the total of nearly $2-billion of research work done during 1951 by the 2000 reporting companies.
- **Research and development work is concentrated** in a small number of companies. More than one-third of the engineers and scientists in the study were employed by the fewer than 20 companies with professional research staffs of 1000 or more. "In contrast, less than 2% were in the employ of the 600 or so companies that reported fewer than five professional research workers."
- **More than half of the 94,000 research engineers** and scientists employed by the reporting companies were working for companies in only three industry groups—electrical manufacturing (including electronics), aircraft, and chemicals.
- **Average research cost per research engineer** or scientist was $22,100 in 1951. Taking all research employees into account, including supporting personnel as well as engineers and scientists, average cost per research worker was $8900.

There are many more details in the report. There are many significant meanings that manufacturing management people can find. But the overriding significance to us is the attention the report calls to the danger of too much reliance on "bigness" in research.

Certainly, there are *some* technological problems best attacked by a "big" project. But to think that our industrial progress is tied to "big" research is a mistake, in our opinion. Some of the "hottest" manufacturing research we see (in too few plants) is being done over in a corner with makeshift apparatus by enthusiastic engineers in both large and small companies

Two of the fields in which this is going on are sonic energy and radioisotopes. So, to provide a starting point for more "small" research in any size company, FACTORY is publishing reports on these fields. The first, on sonic energy, appears in this issue, starting on page 84. The radioisotopes report is coming in April. We hope these two reports, and others to come in the "new technologies," will inspire hundreds of small research and development projects in all kinds of plants. By whom? By anyone in the plant who is alert enough and ambitious enough to take the plunge into an unfamiliar field of knowledge.

Harry Lee Waddell

SONIC ENERGY

industry's new

By CARROLL W. BOYCE • Associate Editor, FACTORY

SONIC ENERGY is now at work solving "impossible" problems for industry. It's also providing a "better way" of solving many routine problems.

Almost unknown as a "work tool" before World War II—except for military applications like Navy Sonar—sonic energy is moving rapidly from the laboratories to the inspection benches and the production floor. But one of the biggest "problems" of sonic energy is that no one yet really knows what it *can* do. Many laboratory-proved techniques are crying for someone smart enough to figure out a practical application.

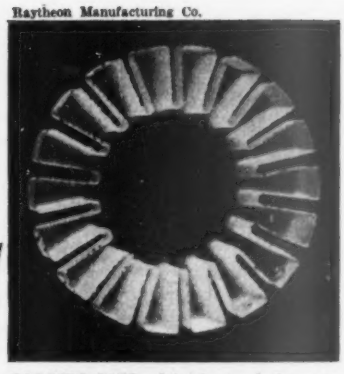
To take full advantage of this new tool, therefore, you need to know these things:

1. What sonic energy is; how you create and control it.
2. The kinds of jobs that might be done in your plant with sonic energy.
3. The jobs that are being done with sonic energy—at least on a pilot scale—to help you *now* to solve such practical problems as these . . .

• PROVED APPLICATIONS OF SONIC ENERGY

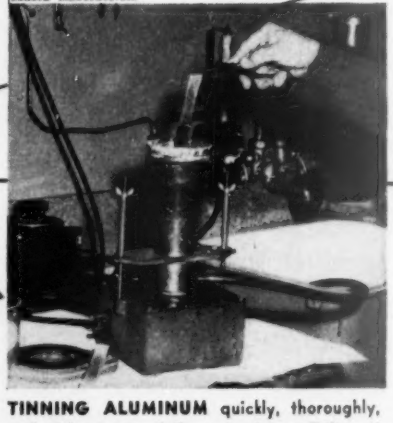
Cutting carbide dies
Inspecting pipes for internal corrosion
Cleaning and degreasing metal parts
Removing oxide scale from metals
Inspecting metals for internal defects
Gaging thickness of sheet steel in stacks
Measuring liquid in sealed containers
Tinning aluminum
Precipitating smoke and fumes
Dispersing and wetting paint pigments
Emulsifying immiscible liquids
Measuring elastic properties of metals
Homogenizing milk
Measuring viscosity of liquids instantaneously
Measuring length of barstock while in racks
Inspecting bonding of laminations

Raytheon Manufacturing Co.



CARBIDE DIES of intricate design can be cut quickly with soft steel "drills." Actual cutting is done by abrasive particles in fluid ultrasonically energized by "drill." For photographing, this ¼-in. dia. extrusion die was cut in plate glass.

Massa Laboratories



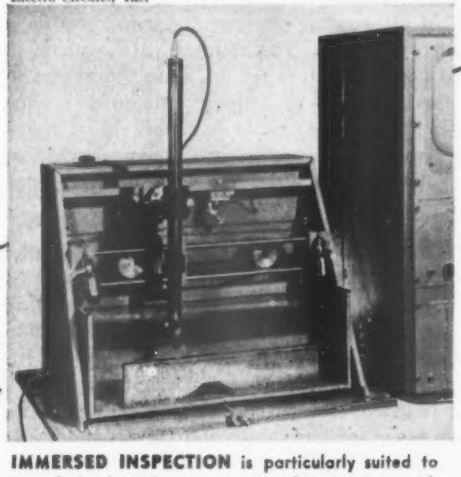
TINNING ALUMINUM quickly, thoroughly, and without use of flux extends possibility of using aluminum and its alloys as electrical conductors. Tinpot is placed atop 27,000 cps. vibrator. Same tinning system is useful wherever you want to avoid use of a flux.

production and inspection tool

General Electric Co.

CLEANING SMALL PARTS on a regular production basis. In this case, it's electric shaver heads at Schick, Inc. Heads are placed on conveyor, carried through ultrasonic bath. The "super-cleaning" action extends even to tiny openings and corners. Technique can also be used for degreasing and removing oxide coatings.

Electro-Circuits, Inc.



IMMERSED INSPECTION is particularly suited to irregularly shaped parts, since surface contact with the part is not needed. The technique also permits mechanical scanning (shown), and "drawing" on cathode tube face a profile of the submerged part, including internal defects.

Magnaflux Corp.

MEASURING THICKNESS of sheet steel by the resonance method (for "echo" measuring, see page 87). The five probes are for use with varying thickness ranges. Calibrations on tube face are for direct reading; they are changed for different materials and range settings.

General Electric Co.

EMULSIFYING immiscible liquids like mercury and water is no trick at all. Here's the result of ultrasonic mixings on a test-tube scale. See page 91 for description of how this job can be done on a continuous production basis.

Turn the page

What Is Sonic Energy?

It's energy transmitted by waves that take the same form as sound waves—alternate, regularly spaced compressions and rarefactions.

But—and this is a key point—useful sonic energy doesn't necessarily create any sound you can hear. The ear of the average human is sensitive to sonic energy only at frequencies of roughly 50 to 15,000 cycles per second (cps.). Some individuals are sensitive as low as 20 cps., others as high as 20,000 cps. So the frequencies from 20 to 20,000 cps. are generally spoken of as audible range.

Audiosonic energy identifies sonic energy transmitted at frequencies within the audible range. (But watch out: Some people use the term "acoustic energy," and others "sonic energy," to describe this limited range, rather than the entire field. To avoid this confusion, we have in effect, coined the self-descriptive term "audiosonic.")

Ultrasonic energy describes sonic energy at frequencies *above* the audible range. That is, roughly from 20,000 cps. up. The limit has not been reached. Present experiments extend to 50-million cps.

Infrasonic energy identifies sonic energy at frequencies *below* the audible range—20 cps. or less.

Those are not hard-and-fast definitions. As in any new field, there is considerable confusion of terms. Some manufacturers, for example, are offering "ultrasonic" equipment that operates at about 300-400 cps., and 7000- to 10,000-cps., both in the audiosonic range. To some extent, the situation is like that in the automotive field, where engines with compression ratios of 6.8 to 1 all the way up to 8-and-more to 1 are being advertised as "high compression" engines.

Ultrasonic vs. supersonic is another point of confusion. But a "gentlemen's agreement" between aviation and sonic energy people is helping to clear it up. Webster says the two terms are synonymous. But, when planes broke through the "sonic barrier," the aviation industry latched onto supersonic to mean anything *faster* than sound. In today's generally accepted usage (now endorsed by the American Standards Association), *ultrasonic* refers to frequencies of sound above the audible range, *supersonic* refers to speeds faster than the velocity of sound.

To find your way around in the sonic energy field, you're going to have to become familiar with some new terms. Here they are:

TRANSDUCER • Any physical device for converting one form of energy to another. As the term applies to sonic energy, a transducer is a device for converting electrical or mechanical energy into sonic energy and (sometimes) *vice versa*.

ELASTIC MEDIUM • Any material which, upon being compressed by physical impact, tends not only to return to its original state, but also to "stretch" beyond this state by a rarefication of its internal structure. Virtually every material is elastic to some degree. Air is very elastic; lead is almost inelastic. Metals like steel, copper, and aluminum have excellent properties from a sonic energy point of view. So do oil and water. Plastics, rubber, syrup, etc., are fair to poor.

COUPLING MEDIUM • (Also called couplant and coupler.) Any material which carries sonic energy from its source (transducer) to the point at which it performs useful work. Air is usually a poor coupling medium, since it is too compressible to transfer the sonic energy it is transmitting into, say, steel. Oil and water, generally, are good coupling mediums.

MAGNETOSTRICTIVE TRANSDUCER • Certain metals, when subjected to magnetic fields, will shrink and then enlarge with each change of the field (during reversal of alternating current superimposed on a direct-current base). The changes in the physical length of the transducer set up sonic vibrations in the air, water, or other "elastic" medium in contact with the end of the transducer. Most magnetostrictive transducers in use today operate at 5000 or 50,000 cps., although experimental ones are being "driven" in excess of 150,000 cps.

PIEZOELECTRIC TRANSDUCER • Certain crystals (like Rochelle salts, quartz, barium titanate) can be made to move physically by subjecting them to rapidly reversing electrical potential. The crystal then vibrates much like a piston. These vibrations set up waves of sonic energy in whatever elastic medium is in contact with the surface. The "natural frequency" of a crystal (and the frequency at which it is most efficient) is determined by its dimensions. Piezoelectric transducers are usually driven at 100,000 to 1-million cps., although they are also being operated at frequencies as low as 9000 cps. and as high as 20-million cps.

WHISTLE (OR SIREN) TRANSDUCER • A moving mass of air exerts pressure that represents mechanical energy. If a mechanical device such as a whistle or siren is used to "chop" this mass of air into uniformly spaced segments, alternately compressing and rarefying them, sonic energy is produced. Most whistles and sirens operate in the audiosonic range. However, there is the fairly common "dog whistle" that operates just above the frequencies audible to a human, though a dog can still hear them.

MECHANICAL VIBRATOR • There are almost limitless ways of producing sonic energy with mechanical vibrations. One of the more useful: Attaching the axle of a rotating, unbalanced flywheel to the end of a bar or rod that is free to move only up or down, causes the rod to pulsate. Design and degree of eccentricity of the flywheel loading will determine

the frequency at which the transducer is most effective. Present applications are largely limited to, say, 60 cps., or less.

The simplest way to create sonic energy is to take a deep breath and then shout your head off. However, that's not a very efficient way to do it. The amount of energy you can put out in this way is too small to do anything more than register as sound on a human ear. For example, a conversational tone of voice puts out about 10 microwatts of sonic power; to do constructive work in industrial applications, power measured in watts, or even kilowatts, is needed.

When you shout, you have demonstrated the principle common to creation of all sonic energy: You put your larynx (or vocal chords) to work as a transducer to convert muscular (or mechanical) energy to sonic energy.

Almost anybody can combine a transducer and a source of mechanical or electrical energy to create sonic energy. But it's a bit tricky to create *useful* sonic energy—to give the energy economic value.

Two things are required if you want to create sonic energy that is useful and has economic value:

1. You must be able to exercise close control over your source of mechanical or electrical power. The control must extend to both frequency and amplitude (or the *amount*) of the input power.

2. You must select a transducer of the correct material and design to "match" both the input power and the output medium. This latter is important because the transducer must be "coupled" to the output medium if it is to operate efficiently. Then you have to make compromises in design to retain the highest possible efficiency while getting the transducer to put out sonic energy in exactly the amount and direction you want.

Design of transducer elements is not a job for amateurs. And there are few experts. Transducer design is still largely in the laboratory research stage. Some "stock" transducers are on the market. They have been developed to do specific jobs, and they do those jobs well. Perhaps they will do other jobs; it is a cut-and-try process to find out.

Where you need relatively small amounts of power at high frequencies (most measuring and inspection applications), transducer selection is not too difficult. Application engineers of the ultrasonic equipment manufacturers have had enough experience.

But where you need relatively large amounts of power (in most present applications, at frequencies of 30,000 cps. or less), almost every application calls for original design by qualified experts of the relatively few companies in the "high power" sonic energy field. Even that often means extensive research, although there are a few "stock models" of magnetostrictive transducers that can be modified for individual problems. High power at frequencies of 100,000 cps. and more is barely emerging from the laboratory stage.

How Sonic Energy Measures and Inspects

Everyone is familiar with echos of the human voice. They're simply sound waves bouncing back from an obstruction. The longer the time for the echo to return, the greater the distance to the obstruction.

The same principle is now being used to measure almost anything that will transmit sonic energy. In industry, measurements in metal where it is convenient to get at only one side or one end of an object are the most common applications.

The reason you can use this technique for measuring in metal is simple: Metal and air do not "couple" efficiently because of the differences in their elasticity and compressibility. So, when the energy impulse reaches the "boundary" of the metal, only a little of it is transferred to the air; the rest of it is reflected back toward the source.

There are two different ways—echo and resonance—that this "boundary reflectance" can be put to work for making measurements or internal inspections of sound-conducting materials. The equipment for the two systems looks quite similar. It is handled in much the same fashion. And in both cases the results are "read" from an oscilloscope (a cathode-ray tube, or highly educated TV screen). But the theory of operation is quite different, so each is peculiarly suited to certain applications.

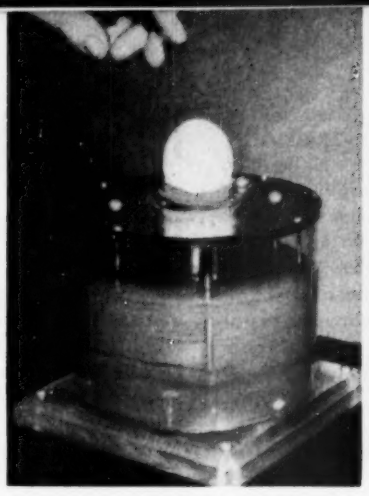
Sperry Products, Inc.

ECHO-PULSE SYSTEM being used to inspect a small metal block for internal defects. By varying the size of the "probe" and the frequency at which it is driven, echo-pulse equipment can be used to measure or inspect through as much as 30 feet of steel.

ECHO SYSTEMS • This is the intermittent signal system already described. In essence, you transmit a brief signal, check the elapsed time out and back. To find out how far the sound signal traveled, you multiply the time by the speed of sound in the particular material you are measuring. The latter is a standard figure that can be looked up in an engi-

WANTED:
Applications for these techniques

One way to find applications for a new tool like power ultrasonics is to turn a bunch of engineers loose and let their imaginations run wild. When General Electric did that, its engineers came up with a batch of useful ideas. They also came up with the four "impractical applications" pictured at right. Problem now is to figure out adaptations with commercial value.



1 SCRAMBLING EGGS INSIDE THE SHELL. Put the egg on top of a beaker of oil energized by high-frequency sonic waves. Enough energy gets through shell to scramble and cook egg.

2 SETTING A BALL OF COTTON ON FIRE WITH A WHISTLE. Focusing the sound waves from an ultrasonic whistle agitates the fibers so vigorously that friction ignites them.

SONIC ENERGY . . . *Begins on page 84*

neering handbook—or you can arrange the electronic circuit in your oscilloscope to do the multiplying for you.

For measuring distances of an inch or more, you can easily get precision of plus or minus 5%, and most of the time plus or minus 2% is attainable. However, with distances of less than half an inch (in most metals), the precision of your results drops off. The *system* is still precise, down to a theoretical minimum of about 0.05 inch on today's commercially available equipment. But the time intervals involved are so short that it becomes difficult for the human eye to "read" accurately the closely spaced "pulses" on the scope screen. (It's a handy coincidence that the point at which the echo system loses precision is roughly the point at which resonance systems are most precise—see below.)

The echo system also has an upper limit. As the sonic waves travel through the material, they lose some of their energy. (If you want the technical word for this, it's *attenuation*.) Finally, a point is reached where not enough reflected energy gets back to the starting point to register on the scope. For example, commercially available echo systems will begin to "black out" in about 25 or 30 feet of steel. Special apparatus can penetrate 100 feet of steel, something more than that in aluminum.

RESONANCE SYSTEMS • Here we find a continuous signal system. The basis of the system is the fact that a given material will have a certain natural resonant frequency which is proportional to its thickness. So what you do is vary the frequency of the input signal until it exactly matches the resonant frequency of the material.

Resonance occurs when the thickness of the material is exactly one-half the wave length of the input signal, or some multiple of the wavelength plus one-half wave length. The result is creation of a standing wave—outbound compressions of the wave coincide with returning compressions, outbound rarefactions with returning rarefactions. Because of the way in which the scope is wired, this produces a sudden change in the potential on the deflector plates of the tube, and you get a neat "pip" in what is normally a straight line across the face of the tube. By putting a "grid" over the face of the tube—carefully calibrated for the particular material being measured—you can read the results directly.

Within the range of 0.0125 to 0.4 inch (in steel), you can get precision of plus or minus 1% or 2% from resonance systems. By using harmonics ("multiple" standing waves), you can extend the range up to 3 or 4 inches, but with progressively less precision because of the difficulty in "reading" the closely spaced pips on the scope. (But note that by the time you have "pushed" the resonance system to the limit of reasonable precision, you are in the range where you can get good precision from the echo system.)

"RELATIVE" MEASUREMENTS • Many times, you aren't interested in how long or how thick something is. You want to know if it has any cracks, flaws, or deposits of foreign material hidden in it. And, if so, approximately how big, and where they are.

An internal "discontinuity" will reflect some, if not all, of the sound waves that strike it. In effect, such a discontinuity is an internal "boundary" of varying efficiency. It will cause an extraneous pip to show up on your scope—either by returning a "premature" echo, or by creating a secondary

3 FLOATING BITS OF CORK IN MID AIR. When you focus the waves from this ultrasonic whistle, the alternate compressions and rarefactions just above the focal point create "cushions" and "pockets" in the air. The bits of cork "sit" on the cushions, appear to be suspended in the pockets.

4 MAKING A WATER FOUNTAIN WITHOUT A PUMP. Focusing high-frequency sonic energy waves at a point just below the surface of this tank causes water to spurt up, fountain style. Where's the application—at 100 times or more the cost of a mechanical pump?

resonance, in either case corresponding to the distance from the transducer to the discontinuity.

By "scanning"—moving the transducer around—you can plot with considerable accuracy the size and location of an internal discontinuity. With proper training, a test unit operator can often identify the *nature* of the discontinuity.

There are times, however, when this ability to locate internal discontinuities can be a drawback. Cast iron is a case in point. The grains in cast iron are so large and the structure so lacking in uniformity that sonic energy waves are dispersed all over the lot. Up to the present, at least, you *don't* make internal inspections of cast iron or other materials with similar large grain structure. Nor can you measure them from surface to surface by the echo system. Resonance equipment, however, can be used to measure the thickness of cast iron up to about 2 inches.

CHOICE OF EQUIPMENT • Almost without exception, piezoelectric transducers are used for metal measuring—whether by echo or resonance. Quartz crystals are most widely used, although barium titanate crystals are being employed in some equipment of this type. Research is going forward on other materials—especially those that can be used to make synthetic crystals, because of the relative scarcity and high cost of quartz.

We noted earlier that a crystal of given dimensions has a certain "natural" frequency. Actually, the crystal can be driven at any frequency, but precision measurements are obtained only when it is driven from roughly one-half to twice this natural frequency.

So, to "cover" a continuous range of distances from less than 1 inch to several feet (in steel), you need to have a set of transducers—crystals of progressively larger sizes. You also need a high-frequency electronic generator (and usually more than one) capable of driving your crystals at any frequency from about 250,000 to 10-million cps. A single oscillator circuit in a generator wouldn't let you cover that range with adequate precision. But you have a choice of buying several separate generators (with ranges centered on, say, ½, 1, 2¼, and 5 megacycles), or a single unit that incorporates several oscillator circuits, with provision for switching from one to another.

There is one other problem involved in transducer selection and use: "Coupling" the transducer to the material being measured.

The solution to the coupling problem, in most cases, is to put a thin layer of heavy oil between the transducer crystal and the metal. This produces, in effect, an airtight seal, and the oil "couples" the transducer to the metal so that for measuring purposes the two operate as a unit.

That's fine when you're moving the transducer (or probe, as it's often called) over a flat surface. It even works well on the outside of a curved surface, when the radius of the curve is 6 inches or more. For smaller radii, you need specially cut crystals that approximately match the radius of the curve. For working on the *inside* of a curve, you always need special crystals, and very little tolerance is possible in matching the exact radius.

IMMERSION TECHNIQUE • Irregularly shaped parts can't be measured with the surface-contact methods described above—you can't keep the probe in contact with this surface. But the job can be done by completely submerging both the transducer and the part in a liquid bath. *Turn the page*

With this technique, you measure the total distance (including distance through the liquid) from the probe to the front surface, rear surface, and any internal discontinuities. Of course, the fact that sound travels at different speeds in the liquid than in the metal means two different scales have to be used in interpreting the pattern shown on the tube face. While it may seem tricky at first, users report that capable technicians have no difficulty after a little practice.

Immersion has additional advantages that suggest its use in some circumstances where irregular shapes are not a problem:

1. **Mechanical scanning is possible.** The probe can be mounted on a trolley-type holder that will move it back and forth at constant speed over the area to be "measured" or inspected.

2. **Defects can be located very close to the surface of the part or material being inspected.** Because of the liquid between the probe and front surface, the usual limitation on minimum measurable distance does not apply here.

POINT-TO-POINT SYSTEMS • In all the systems described so far, a single transducer has been used as both the "transmitter" and "receiver" (of either echo or resonance signals). For some applications, often in connection with the immersion technique, better results are achieved by using two transducers. The level of the energy "received" at the second transducer indicates the presence or absence of obstructions between the two points. Obviously, resonance cannot be used for this type of inspection. But it is possible to use either a continuous or intermittent signal, depending on the basic equipment you want to use.

DETERMINING "CONSTANTS" OF MATERIALS • Sometimes you already know, or are not interested in, physical dimensions (including defects) of a material. You want instead to determine its modulus of elasticity or (for liquids) its viscosity and density. Variations in such "physical constants" cause changes in the rate of propagation (or spread, like ripples) and attenuation of sonic energy.

Let's say, for example, that you want to measure the viscosity of a free-flowing (Newtonian) liquid such as lubricating oil. By using samples of known viscosity, you can compute from test readings the propagation and attenuation rates for any given viscosity. Then, by measuring propagation and attenuation rates in a sample of unknown viscosity, it is possible to "figure backwards" and determine the previously unknown viscosity.

Don't worry if the "pre-tests" and computations sound a bit complicated. The commercially available instruments to do this job are complete with table-top-size electronic computers that let you read results directly.

When it comes to measuring sticky (non-Newtonian) liquids such as glues, paints, gelatin, slurries, etc., this technique will not give you a true viscosity reading. Also included in the reading of apparent viscosity will be the effect of the inherent shear rigidity of the liquid. In many cases, however, this will be a positive advantage, since process control and quality control of non-Newtonian liquids often require measurement of just exactly this combination of viscosity and shear rigidity.

General Electric Co.

POINT-TO-POINT METHOD of ultrasonic inspection demonstrated in G-E laboratories "transmits" signal from one probe, "receives" it at the other. Intensity of sonic energy received as probes are moved indicates presence or absence of obstructions in path, thus tells of variations in thickness of metal plate, cracks, air pockets, etc.

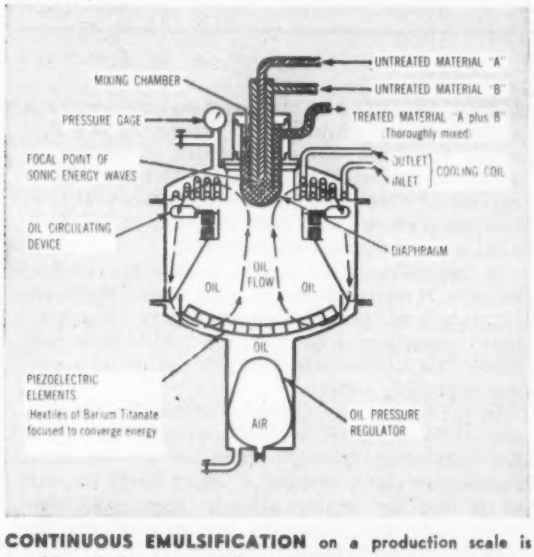
Ultra-Viscoson Corp.

VISCOSITY of liquids can be measured instantaneously. The magnetostrictive probe is inserted in kettle or pipe. The "computer" shown here can be attached to control equipment, if desired, to provide automatic process control or quality control.

Measurement of the modulus of elasticity (Young's modulus) is accomplished in much the same way: By measuring samples with a known modulus, you calibrate your equipment to read directly the modulus of unknown samples.

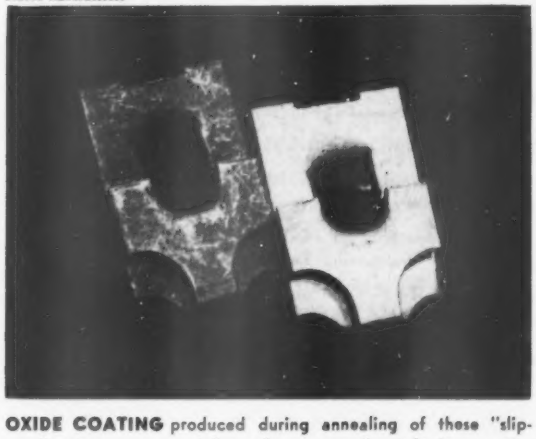
Present commercially available equipment for measuring physical constants operates at much lower frequencies than "dimension measurement" equipment. For that reason, magnetostrictive transducers are employed. The probe is inserted into the liquid (either in a kettle or pipe), and by varying the sensitivity of the system it is practical to measure viscosities as high as 50,000 centipoises x grams/c.c. Where corrosive materials are encountered, you can gold-plate the probe (about 4 inches long) to protect it.

Brush Development Co.



CONTINUOUS EMULSIFICATION on a production scale is possible with this system of focused sonic energy waves converging at the outlet of two concentric pipes. Pilot plant models have been run on test 1000 hours and more.

Massa Laboratories



OXIDE COATING produced during annealing of these "slip-over" nuts was removed from the one on the right in a matter of seconds. Does the cleaned nut look a bit rusty? It is. The 27,000 cps. cleaning bath did such an efficient job that the nut started to rust a few minutes after exposure to air. Lacquer, varnish, or any standard rust inhibitor will overcome this too-good-a-job drawback to a super-fast substitute for the conventional pickling process.

How Sonic Energy Supplies Useful Power

Technically, it is incorrect to imply that measurement applications do not require power; they do. But the term "power applications" is generally reserved to identify situations in which the level of power is high enough to do some constructive work. That is, to bring about a permanent physical or chemical change in the part or material which is subjected to the impact of the sonic energy.

In most cases, the actual work is done not by the sonic energy as such, but by either agitation or cavitation caused by the sonic energy waves.

AGITATION • When sonic energy moves through an elastic medium, it creates alternate compressions and rarefactions in the medium. That's a matter of definition of sound waves. The result is violent agitation of the individual molecules of the medium, following this same compressional pattern.

If you are trying to mix two liquids, for example, this molecular agitation will sometimes do the job —even when the liquids are normally immiscible. Often, however, cavitation (see page 92) is needed to get this result.

An "indirect" result of molecular agitation is a scrubbing, almost abrasive action. This permits you to remove dirt, grease, and "loose" coatings from the surface of parts or materials immersed in the agitated medium. Note that here the action is simply a result of the movement of the molecules of the elastic medium.

If you want to get a more vigorous scrubbing action—a truly abrasive, cutting action—you put tiny particles of abrasive in the coupling medium. Molecular agitation of the medium causes these particles to move minute distances, but very rapidly and with tremendous force. Now you can remove paint, rust, and "tight" coatings from surfaces, and actually begin to chew up the surface itself of a submerged part or material.

Obviously, if you want to bat around abrasive particles, the amplitude of the sonic energy waves in the elastic medium must be fairly large. That is, each cycle of the sonic vibration must make the molecules of the medium move back-and-forth far

enough so that a whole bunch of them can gang up, accelerate to high speed, and then slam into one of the abrasive particles with enough force to drive it into the surface of the submerged part.

CAVITATION • This is the process of creating tiny vacuum pockets in water or other liquid medium. It is caused by violent agitation of the liquid. Cavitation is a common phenomenon associated with ship propellers. In that case, it is caused by the rotation of the propellers, and many of the vacuum pockets form right at the surface of the propeller blades. Besides causing a "drag" on the propellers, the collapse of the vacuum pockets exerts tremendous pressure on the blades, pits their surfaces.

With controlled sonic energy, you can make this same reaction take place in any liquid. The waves of sonic energy make the molecules of the liquid move back and forth rapidly and violently. Just the right intensity (combination of frequency and amplitude) of the sonic energy waves will literally "tear apart" the molecules of liquid, causing vacuum pockets to form. When these pockets collapse an instant after formation, the effective pressure is equal to several thousand atmospheres.

There are two ways you can put cavitation to work for you: Direct impact on the surface of the submerged part or material, or acceleration of abrasive particles in the coupling medium.

In practice, it is difficult to distinguish the upper limit of agitation and the lower limit of cavitational effects. When cavitation first begins, the vacuum pockets formed are too small to be detected.

But as power input increases, cavitation has the effect of driving the dissolved air and gases out of the liquid and producing "pockets" large enough to be seen with the naked eye.

While cavitation can be produced at any but the very highest frequencies (say 100-million cps. and up), its effects become much more dramatic as frequency is reduced:

At 8000 to 30,000 cps., cavitation in an abrasive-filled liquid (almost a paste) makes it possible to cut tungsten carbide almost as though it were cheese (well, stale cheese, maybe). It looks as though the cutting were being done by a soft steel drill. But, if you try that, you'll soon find it won't work. Actually the "drill" is simply the driving head of a magnetostrictive transducer; the cutting is done by the abrasive in the liquid that separates the "drill" from the carbide. The photograph on page 84 shows one of the complex cutting jobs you can do in this way. The sample is plate glass—no carbide "samples" were available. This cut is about ¼-in. deep; took about 1½ minutes to make it. In carbide, it might have taken as much as ten minutes.

At 20 cps. or less—down in the infrasonic range—cavitational effects make it possible to ram an oil well through solid granite. The neat thing here is that once the process is underway, the small chips broken away from the bedrock keep replenishing the supply of "natural" abrasive. You merely have to keep pumping in a supply of water. The technique works as well, and even more rapidly, in softer mediums like limestone, shale, and compacted clay. In case you don't need an oil well, you might keep it in mind for water wells and perhaps to secure footings for plant foundations.

ACKNOWLEDGEMENT • This report on sonic energy is a summation of attitudes and experience in a field where there are many differences of opinion. It would be incorrect, therefore, to assume uniform agreement even among those companies that have been so generous with their cooperation and technical advice in preparing the report.

A special word of thanks is due the staff of Battelle Memorial Institute, Columbus. While the Institute is not part of the sonic energy "industry," much important research in the field is underway there. The independent viewpoint of its personnel was especially helpful.

In expressing our appreciation for the cooperation of the industry, we call your attention to the fact that many "young" companies are important pioneers in sonic energy. A lot of them are still small and not widely known. Then, too, some older-established companies are moving into the field quietly and, perhaps, tentatively.

No one has been deliberately overlooked. But the situation described makes it probable that this list is less than a "definitive roster" of the sonic energy industry:

Branson Instruments, Inc., Stamford, Conn.

Brush Development Co., 2405 Perkins Ave., Cleveland 14.

Cavitron Equipment Corp., 7 W. 45th St., New York 36.

Electro Circuits, Inc., 401 E. Green St., Pasadena 1, Calif.

Fairbanks Ward Industries, Inc., 666 N. Lake Shore Drive, Chicago.

General Electric Co., Laboratory Information Service, General Engineering Laboratory, Schenectady, N. Y.

Magnaflux Corp., 5900 Northwest Hwy., Chicago 31.

Massa Laboratories, 5 Fottler Rd., Hingham, Mass.

Raytheon Manufacturing Co., Waltham 54, Mass.

Soundrill Corp., 3300 Cahuenga Blvd., Los Angeles, 28.

Sperry Products, Inc., Danbury, Conn.

Topper Equipment Co., Clark Township (Rahway), N. J.

Ultrasonics Corp., 61 Rogers St., Cambridge 42, Mass.

Ultra-Viscoson Corp., 1240 Main St., Hartford 3, Conn.

Westinghouse Electric Corp., Research Laboratories, East Pittsburgh, Pa.

How you can ...

...MEASURE AND INSPECT WITH SONIC ENERGY

Dimensioning

1. Absolute measurements. Distance from one "wall" to the other of any homogeneous, sound-conducting material can be determined to a high degree of precision. Primary application is where it is impossible or inconvenient to reach both sides or both ends for normal measurement—for example, finding thickness of a boiler tank wall or length of an I-beam set in concrete; checking the length of bar stock without removing it from rack; or gaging the thickness of strip or sheet (especially in the center of a sheet). Or maybe you want to check the height of liquids in sealed containers. You can if the walls of the container are parallel or cylindrical.

2. Relative measurements. Some inspections merely require that you determine *uniformity* of length or thickness. When that's the case, the technique is the same as for absolute measurements, but precise calibration is not needed, since you're interested only in variations from one "reading" to the next.

Almost without exception, the inspection and detection applications listed below are simply relative measurements from an outside surface to an "internal discontinuity" on reflecting surface short of the far surface.

Inspection and Flaw Detection

... with surface probes

1. Solid objects. Moving a probe over the surface of an object permits location of internal cracks, flaws, and deposits of foreign material. They can be "seen" on an oscilloscope screen attached to the probe. Distance between indications on scope tells approximate distance to the discontinuity. Particularly useful at present for internal inspections of forgings. On turbine shafts, for example, it often eliminates the need for an axial test bore. Also used for production testing of items such as crankshafts, axles, propeller mountings, etc.

2. Hollow objects. To inspect, say, a pipe, you don't have to move your probe all the way around circumference of the pipe. By mounting a crystal on a wedge, you can angle the sonic waves into the metal to make them bounce back and forth between the inner and outer surfaces and come back to the starting point (the probe). Cracks or flaws in the pipe (or major changes in its wall thickness) will show up as irregularities on the oscilloscope screen. Not as precise as with straight "out-and-back" inspection, but satisfactory for many applications.

3. Welds. A weld, by its very nature, will produce an internal discontinuity. But a *good* weld will provide only a minor reflection, and it will be a uniform reflection along its entire length. A non-uniform reflection will indicate cracks, air holes, or foreign matter in the weld—all signs of weakness. Checking welds of two flat surfaces is fairly satisfactory; checking welds in pipe is trickier, less precise, but still possible.

... by immersion

1. Solid objects. Irregularly shaped objects, in particular, are easily inspected by submerging them in a tank of water. When so immersed, the probe need not be in physical contact with the surface. Flaws close to the surface (say, 0.10 inch) are easily detected by this method. When aluminum is immersed in mercury, for example, inspection of the actual surface is possible.

2. Tires. This is a new one, just announced by Goodyear Tire & Rubber Company (one of the first developments to be reported by a user rather than a supplier of sonic energy apparatus). In this case, sonic waves are transmitted between two points, rather than the customary "out-and-back." The transmitter is placed in the bottom of a tank of water or alcohol. The pick-up is placed so that it is inside the submerged portion of a tire being rotated through the bath. Meter readings of the sonic energy intensity at the pick-up point disclose the presence of cracks or breaks in the tire carcass or cords. Present use is to verify soundness of used tires before recapping.

Measuring "Physical Constants"

1. Viscosity. Since viscosity affects the rate of propagation and attenuation of sonic energy waves, it is possible to make instantaneous and continuous readings of this important property. It eliminates the need for taking samples to a lab for analysis.

For free-flowing liquids, the measuring equipment measures true viscosity. For sticky (non-Newtonian) liquids like glue and slurries, it measures apparent viscosity, or the combined effect of true viscosity and shear rigidity. When desired, the measuring instrument can be connected to process equipment for automatic process or quality control.

2. Modulus of elasticity. This property also affects rate of propagation and attenuation. With ultrasonic equipment, it becomes possible to measure the modulus instantaneously—while parts are undergoing test or while they are in place in the field.

Turn the page

How you can . . .

. . . DO PHYSICAL WORK WITH SONIC ENERGY

Cleaning

1. Cleaning small or delicate parts that must be critically clean—such as surgical instruments, ball bearings and their assemblies, cutting heads for electric razors, fine screens and grids for vacuum tubes. You can get them cleaner than was ever possible before. Cost is fairly high, but the result can't be duplicated by other means at any cost. An additional advantage is that you can clean surfaces that are not normally exposed (i.e., the hollow shaft of a hypodermic needle, the inside of an assembled bearing race). You get the same degree of cleanliness as on "normally exposed" surfaces.

2. Degreasing metal parts as preparation for plating. For anything other than very small parts you'd need to pump sonic energy into a bath so large that present cost is 'way out of line, competitively. But immersion time is cut to perhaps 1% or less of what is required in a conventional degreasing bath.

One spectacular possibility is continuous degreasing of steel strip in a tin-plate mill. Length of tanks needed could probably be cut to 10 or 20 feet. However, building a tank even that size would probably cost at least $250,000 to $500,000. To do the job, you would have to "gang" hundreds of transducers (most likely magnetostrictive). The problem of "matching" and cooling them would be tremendous. And the cost of electric power to operate the bath would be high.

3. Removing oxide scale or coatings. You can do this with any metal, but it's of particular importance with aluminum, since no good flux is available. An ultrasonic soldering iron, for example, literally tears off the oxide coat that forms on aluminum *and keeps it off* until the "exposed" area is protected from air by the application of the solder. Tinning aluminum is done in much the same way: the tin pot is placed on top of an ultrasonic transducer. When the aluminum is placed in the tin, the sonic energy rips off the oxide coating, permits the aluminum to be tinned.

Apart from aluminum, the technique has applications wherever you want to avoid the use of a flux—as in vacuum tubes.

4. Ordinary laundering of cloth. After repeated washing in the strongest detergents available, cloth is still filthy by the standards possible with ultrasonic cleaning. The outstanding problem when you use high-frequency energy—apart from high cost—is that only one layer of cloth can be cleaned effectively at one time. The first layer cuts down on energy transmission so severely that you don't have enough energy left to do a really good job on a second layer away from the power source. The way out seems to be to add a mechanical agitator to the laundry—so that finally all the cloth involved will have been "directly exposed" to the sonic energy. In a low-frequency approach to this problem, a "home size" unit (capacity 14 pounds) uses part of its sonic energy output (at 60 cps.) to agitate the laundry.

"Drilling" (abrasive cutting)

1. Metals, including tungsten carbide. This is being done in an increasing number of shops. Cutting chip breakers—a particularly difficult job with abrasive wheels—is almost a cinch with an ultrasonic "drill." Cutting square holes and other unusual shapes in carbide extrusion dies to close tolerances gives promise of expanding the horizons for extruded metals considerably. The only "problem" is getting the right design for the magnetostrictive transducer to do each job. It's tricky, and not many people are qualified to design the transducers. How to design a transducer that will undercut still stumps the experts.

2. Glass and gems. Most jobs being done in this field are closely allied to etching—at least in terms of the physical appearance of the result. Since less material is to be removed and smaller areas "operated on," equipment is generally driven at higher frequencies. Cutting intaglios in onyx, garnet, and even amethyst and emerald is a swift job—but it still requires great care and a skilled artisan.

Agglomerating and precipitating

1. Smoke. What we call smoke is simply a suspension of particles (usually carbon) in air. If you agitate the air just enough but not too much, you set the particles in motion at such a speed that when they hit each other in the course of moving back and forth, they will stick together. After enough particles have collected around a single core, the unit becomes heavy enough to precipitate. If this is done inside a chimney, the particles of soot never get loose—they fall back down the stack for collection.

Some people think this represents the ultimate solution to the smoke problem. Trouble is, at present, it is very expensive and the frequencies

most capable of transmitting enough energy in air to do this job are smack in the middle of the audible range. However, sirens are being operated at about 20,000 cps. (just barely above the audiosonic limit), and they are proving successful.

2. Fumes. The problem here is the same as with smoke from the sonic energy point of view: noise and high cost. But a mill that pours out sulfuric acid fumes, for examples, can not only protect its town but get a small return on its money: The precipitated fumes are recoverable in the form of dilute sulfuric acid.

3. Colloidal suspensions. You can do in a liquid the same thing you do in air—only much more efficiently and at less objectionable frequencies. Say, for instance, you want to precipitate the suspended dye in a bottle of India ink. Technically, it's possible. The thing that has stumped the experts so far is why anyone would want to precipitate the dye in India ink. Here's a technique just waiting for someone to figure out a worthwhile application.

4. Fog. Precipitating fog to clear the atmosphere sounds like a crackpot scheme. From a technical point of view, many experts think it could be done. What does make the idea rather zany is the size of job involved. A rough calculation indicates that the entire power output of Grand Coulee Dam would be just about enough to clear the air up to a 100-ft. ceiling over San Francisco Bay. And that's figuring conservatively. But more efficient apparatus may someday make it practical.

Dispersion of Agglomerates

1. Paint. Dispersing the pigment through paint requires that it first be ground into very fine particles and then mixed vigorously for considerable time, until each individual particle is thoroughly wetted. This obviously could be done by sonic energy. Because of the cost, however, sonics is not likely to make the ball mill obsolete in 1953, or even 1954; but the time may be coming.

If the base in which the pigment has been placed is agitated violently, the fairly large particles of pigment agglomerate will move back and forth and hit each other with so much force that they bust up into small particles. At the same time (and probably more important) the agitation speeds up the wetting process tremendously.

(Note that whether you produce agglomeration or dispersion is simply a matter of the violence of the agitation in relation to the nature of the particles involved.)

In almost every case, however, cavitation is needed to get sufficient dispersion. Collapse of the vacuum pockets created by cavitation builds up enough pressure to pulverize any over-size particles and reduce them to the size where they go into suspension. Trouble is that cavitation rate is relatively slow, so the process is rather long and drawn out—and therefore expensive.

Mixing and Homogenizing

1. Immiscible liquids. Water and oil, mercury, and many other normally immiscible liquids can be mixed by violent agitation of the molecules of *both* liquids at the same time and place. That last qualification makes it just a bit tricky. Simply dumping oil and water into a beaker placed on top of a high-frequency transducer will do the job, ultimately, but it's slow and not too efficient.

There are two possible ways of doing the job efficiently—both just coming out of the laboratory. Both involve the use of transducers that permit you to focus sonic energy (the waves always move out perpendicular to the emitting surface of the transducer).

Using as your transducer a mosaic of barium titanate hextiles "planted" in a spherical shell, you can focus the energy at the point where two concentric pipes bring the liquids into physical contact with one another. A third pipe or overflow from this continuous system removes completely mixed "immiscible" liquids (see diagram, page 91).

With a section of pipe made out of barium titanate, you can focus energy along the axis of the pipe. That, too, will permit continuous mixing.

2. Milk. You can homogenize milk very handily with sonic energy. Up to the present time, however, the only way of getting enough energy efficiently for the quantities involved has been by using frequencies in the audible range. So the process hasn't gone far from a commercial standpoint—too noisy as well as too expensive.

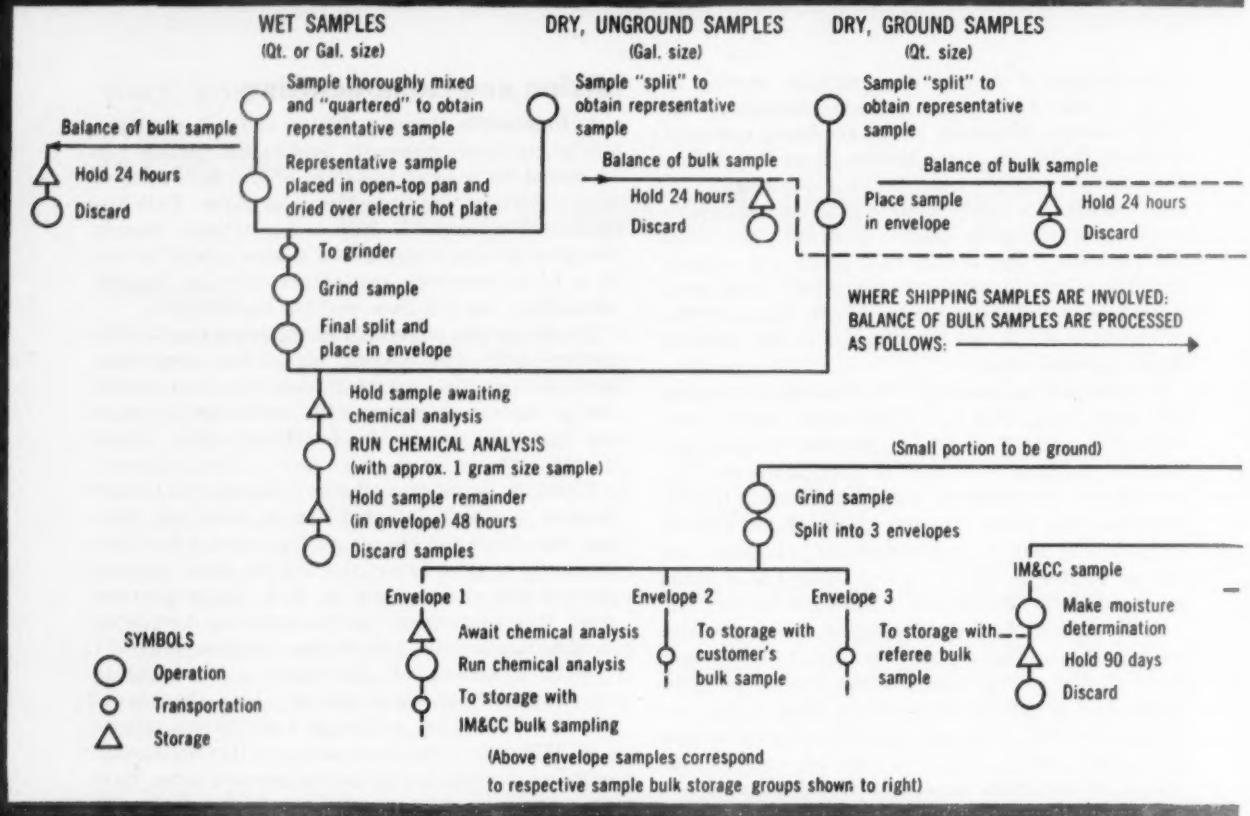
An interesting "side effect" of homogenizing milk is that you can partially pasteurize the milk in the same operation. The agitation of the molecules slams bacteria around so violently that some types are knocked to pieces (in a literal sense) by the process. The catch is that other types of bacteria thrive on this kind of treatment and multiply more rapidly than usual.

Reducing Friction

Here is a combination of cleaning and the "pure" vibration produced by sonic energy waves.

By coupling a magnetostrictive transducer to the tool bed on a lathe, you can effectively shake loose much of the dust and grime that impedes the smooth forward movement of the carriage. In effect, the static friction of the bed becomes "rolling friction" upon application of the sonic energy.

Result: Static friction and sliding friction are nearly equalized. In conventional operation, static friction is many times sliding friction. So when you give the carriage enough "push" to overcome static friction, you are then pushing it too hard to just balance the retarding force of sliding friction—and you get overtravel. Then the carriage, in effect, must come to rest for an instant and start over again.



PROCESS CHART, a familiar tool of the methods engineer who sets out to improve production, was used here to analyze laboratory processes. It showed that lab work broke down into four major kinds of jobs—that it was essentially a mass-produc-

With Work Simplification...

A Lab "Goes Mass Production"

MANY COMPANIES use good layout and work simplification to make production savings. But many companies—like our own—also have pretty expensive service operations. Better methods pay off there, too—as we found out.

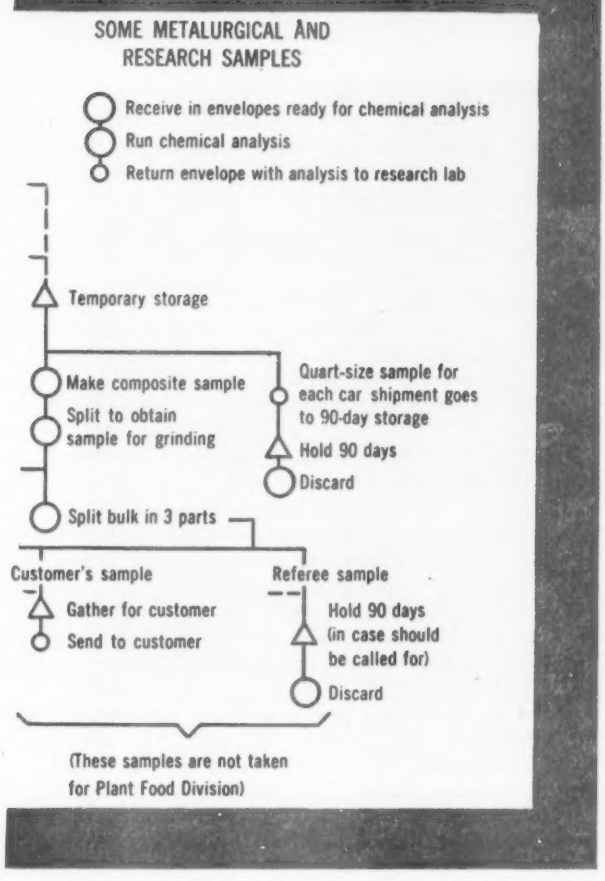
Case in point is the new analytical laboratory of our Florida Phosphate Division (Noralyn, Florida) where we should cut costs by approximately $40,000 a year. We haven't completed a check of savings, but that amount is in the cards. Further refinement of methods may boost it to an even higher figure.

Besides the operating savings, changes in selection and storage of samples eliminated the need for approximately $24,000 worth of new building.

APPROACH TO PROBLEM · Before we built the new lab we were doing the work in five separate locations. Of course, they had grown up with the operations—like neglected stepchildren. After all, a lab is a "non-productive" operation.

Various attempts were made to justify a new laboratory. But the results always turned out to be expensive. It was difficult to take the step to spend so much for new walls around an unchanged operation—especially when production projects looked like better investments.

Then we tried a different approach. We analyzed methods and practices of the old laboratories. The process chart above is an example of the technique we used—the same technique that's used to analyze


SOME METALURGICAL AND
RESEARCH SAMPLES
Receive in envelopes ready for chemical analysis
Run chemical analysis
Return envelope with analysis to research lab
Temporary storage
Make composite sample
Split to obtain sample for grinding
Quart-size sample for each car shipment goes to 90-day storage
Hold 90 days
Discard
Split bulk in 3 parts
Customer's sample
Gather for customer
Send to customer
Referee sample
Hold 90 days (in case should be called for)
Discard
(These samples are not taken for Plant Food Division)

tion type of operation that lent itself readily to application of principles of methods improvement.

WORK STATIONS were designed in accordance with work simplification principles to fit specific jobs.

Just happened to be an analytical laboratory. Could have been any other service operation. The principles of work simplification pay off there just as they do in production.

By THOMAS M. WARE • Vice President, Engineering Division, International Minerals & Chemical Corporation, Chicago

production. We found many opportunities to improve methods. And, after we found a new layout and new methods, we discovered we didn't need as much building, either. The cost reduction goes a long way toward paying for the new building.

Incidentally, just *changing* layout and methods in the old building wasn't practical in our case. Remember, we had five separate laboratory locations. But if *you* have a good building now, you still may save yourself considerable money by relayout, and by better methods and equipment.

This time we approached the new building problem from the standpoint of function.

First we took a broad look at the work of all five of the old sample preparation centers—to see if consolidation made sense. The answer to that was fairly obvious. There was enough similarity in type of sampling and analysis to combine them into a single facility. It was like combining five small job shops into one plant doing volume production.

SITE SELECTION • The real problem in consolidation was one of transportation and communication—getting samples to the laboratory and analyses back to operations. It was a problem of "plant" location.

Here are the factors upon which we based our choice of location:

• Urgency of analysis of samples from eight sources at a maximum distance apart of 13 miles.

• Potential means of transporting samples to

the laboratory and reporting analytical results back to the sources.

• Plans for future changes in operations in the area.

• Location and suitability of existing structures that could serve as auxiliaries to new facilities.

All things considered, we selected a site where we had set up a temporary laboratory. Strangely enough, this laboratory location had resulted from the inadequacy of our old Mulberry lab. It's reasonably central with regard to volume of samples, and the other factors. We eliminated all other laboratories except one. To provide immediate screen analyses at the grinding mills we set up a small station at the mills for that purpose only.

WORK ANALYSIS • Our next step was to analyze the work of the laboratories to determine the actual need for space and equipment. We tackled the job as we'd analyze a production operation. We made use of time studies, process charts, and flow charts for analysis. We visited other laboratories to observe type of building, layout, equipment, and methods. We looked at a lot of laboratory equipment and discussed it with the salesmen. We pored over trade magazines looking for ideas.

We analyzed the work in two steps. First, we made flow charts of all the work performed in our laboratories, following each type of determination from sample to storage.

We found most of the work (see chart) in four basic types of determinations. And, looking at it this way, we saw we had a big-volume (or mass-production) operation in which many parts of the processes were highly repetitive. In fact, this was the first observation of the similarity of our analytical tasks with the production line. It gave us our clue to real savings.

Our techniques were outmoded because we hadn't recognized the parallel of factory mass production methods. We were processing chemical samples on a batch basis, and each chemist performed all operations on a unit group of samples.

Our second step, therefore, was to make detailed studies of individual analytical processes—methods, techniques, and equipment. Here we used time study and process charts to set down the cold facts of operation, to get a picture of how we were doing the work.

For example, we found there were 55 separate steps to a "BPL" determination—all performed by one chemist. We were using facilities much like you'd find in a school laboratory. Calculation showed our chemist walked 1470 miles per year to do this work. And cutting one second off the time to perform one step of the process was worth $557 of chemists' time per year. That looked promising.

Flow charts and analysis also showed us that storage of samples, after splitting and running chemical analyses, would require one-third the area of a new laboratory. We also discovered we were storing samples taken for moisture tests. Obviously, they were meaningless after testing because moisture content changes in storage.

WORK SIMPLIFICATION • We decided to improve and simplify methods, procedures, and equipment for operating a laboratory. Here's the way we did it:

• **Set up revised transportation schedules to get samples faster and spread over the day to minimize surges.**

• **Where possible, we reduced the size of samples stored, and the time they were held.** In one case a sample was cut from 10 pounds to envelope size. In this step we consulted research and sales to help us make these reductions. In many cases we were able to eliminate sample storage entirely.

• **Broke each determination into fundamental parts to the point where one man could handle a minimum number of steps conveniently and effectively.**

• **Set up specialized jobs to perform fundamental operations.** For instance, approximately 3000 weight determinations are made in a day on laboratory balance scales. That job requires a high degree of manual dexterity. It made sense to make a special job of the operation. Titration is another example; it requires a high degree of visual acuity.

• **Designed work stations for specialized operations in accordance with the principles of motion economy.**

• **Purchased or designed equipment that made the work faster and safer.** For instance, we bought pipettes that automatically dispense a predetermined volume of liquid. But our own engineers designed a special machine that automatically stirs twelve sample solutions at a time.

• **Arranged the work stations in a layout that permits the majority of samples to flow through the laboratory in a straight line.** The layout also minimizes distances between operations.

• **Designed the building around the layout.** Of course, we had to make some compromises here, but they were minor.

• **Set up foreman responsibilities to help him continue improvement of the operation.** It's his job to:

1. Schedule work loads to keep them balanced.
2. Maintain the mass production concept; keep methods and procedures simple and effective.
3. Be alert to safety requirements.
4. Assign and maintain job responsibilities.
5. Keep the laboratory clean and orderly.
6. Continue study of methods, procedures, and equipment to effect further improvements.

The end-result—the new laboratory—is not only pleasing; it's also a real contribution to economical operation of the Phosphate Division.

HUMIDITY-CONTROLLED STORAGE is provided for austenitic welding electrodes in this room at Cadillac Tank Plant. Ferritic type 230 electrodes are also dry-stored in a similar room. Relative humidity in both rooms is kept at 50% or less.

For better welds...

...Dry-Store Your Welding Rods

NEWER TYPES of coated welding electrodes pose a storage problem for big users: *how to control the moisture content of their absorbent coatings.* Too much moisture deteriorates electrodes, thus slows welding speed and lowers weld quality.

The answer at Cadillac Tank Plant, Cleveland, is humidity-controlled storage. Well worth its $40,500 cost, it has cut problems arising from faulty welding electrodes to "almost nothing," says Cadillac.

Excessive moisture in electrode coatings causes porosity and under-bead weld cracking. The coating may pop off and leave the electrodes useless. Worse yet, welding with a defective electrode results in weld and parent-metal cracking. This involves the cost of electrodes, welding time, weld-removal time, more electrodes, and re-weld time—plus such indirect expenses as storage, power, and materials handling.

You can't tell whether an electrode's moisture content has been exceeded until you weld with it, or else have it analyzed in a chemistry laboratory. That's why close control of humidity during storage is the only safe answer.

Cadillac Tank installed separate facilities for two kinds of electrodes — austenitic and ferritic type 230. Though the two differ in moisture tolerance, they could be stored together. But separate storage suits Cadillac's layout.

Austenitic electrodes are costly and hard to get because of their high alloy content. Cadillac Tank uses large quantities of them, must keep a 3-month supply—750 tons—on hand.

So $26,000 was invested in humidity-controlled storage. The storeroom is a 25 x 225-ft corridor running through an unexcavated area. Double doors block it off at each end. Two 7½-ton air conditioning units—located at opposite ends—cool the air to wring out the moisture. To maintain a comfortable temperature, dry air is pushed into the room through heating coils. Walls, ceiling, and floor are poured concrete—no surface sealing.

Ferritic type 230 electrodes are dry-stored in a 29 x 75-ft. room that cost $14,500. It's equipped with a single 7½-ton air conditioner. Walls, floor, and ceiling have an asphalt vapor barrier coating.

In both rooms air conditioners are set at 30% relative humidity, which, allowing for frequent opening of doors, keeps humidity at 50% or less.

IDEAS OF THE MONTH for

By LEWIS K. URQUHART • Managing Editor

ASARCO CONTINUOUS-CAST BRONZE comes cut in any length you want from 1 inch to 20 feet. (No sense in buying 13 inches when you want only 8, is there?) American Smelting & Refining Co., Barber, N. J.

SAFETY INNERSOLES (Rubberhide Co., Inc., 712 Whitehead Road, Trenton 4, N. J.) protect workers from foot injuries caused by nails and other sharp-pointed underfoot objects. They consist of a thin, flexible sheet of high-tensile spring steel, bonded to a layer of sole leather on the top side and a sheet of rubber-impregnated canvas on the underside.

SPOTCHECK is a pressure-canned dye penetrant used to locate cracks in solid materials. The makers (Magnaflux Corp., 5900 Northwest Highway, Chicago 31) now announce a $35 test kit you can carry to the job.

BOOKLET OF THE MONTH is one every plant engineer should have. We mean General Electric's "Industrial Power Distribution Idea Book." It's a 28-page, 2-color job. Covers utility distribution practices, methods of buying electric power, what to do when a choice of primary voltages is available, application of primary switches and circuit breakers, types and arrangements of primary cables, and types of load-center distribution systems. Write G-E, Schenectady 5, N. Y.

FOR EQUIPMENT IDENTIFICATION you can get "Serially Numbered Autographs" from Metalcraft, Inc., Mason City, Iowa. In three stock rectangular sizes on .016" chrome metal. Company name is lithographed in two colors. Serial numbers are stamped into the surface. Plate is backed with a ready-to-use, solvent-reactivated adhesive that sticks permanently to any grease-free surface. Metalcraft also offers "Numbergraphs," with numbers only.

HYPO LUBRICATING KIT contains (1) pen-size oiler with hypodermic needle and cap with pocket clip; (2) junior size of same; (3) pen-size grease gun; (4) adapter with hypodermic needle that can be screwed on tubes of oil, grease, cement, or glue. $3.75. Gaunt Industries, 827 Irving Park Road, Chicago 13.

NEOPRENE RUBBERS will be good news to men who work around solvents, acids, other chemicals. They're light and comfortable, anything but clumsy. And weigh only 9 oz. apiece. Secret is no fabric lining. Worker can wear same pair for street and shop; uppers stretch enough to insure a snug fit over street or work shoes. Tingley Rubber Corp., 903 Ross St., Rahway, N. J.

BIN BOXES made of chemically hardened corrugated board can be had from Convoy, Inc., Canton, Ohio. Instead of scooping out the contents at inventory time, you pull out the entire box and weigh it. These boxes save cost of bin dividers, have riser front to increase capacity.

RENT A FORK TRUCK (if you can't afford to buy one). Yale & Towne Mfg. Co., Phila., has announced a rental plan in conjunction with CIT Corp.

Factory Executives

COMPARISON CHARTS will help you buy electric trucks right. Lewis-Shepard, Watertown, Mass., sends them free. For regular fork trucks, walkie trucks, and riding-type tiering and hauling trucks.

CONSERVATION is a wonderful idea. But the smart company knows where to stop. For instance, B. F. Goodrich Co., Akron, finds it cheaper to buy 1600 new pails a month than to clean old ones. It uses the pails to mix rubber cement, which sticks for keeps.

Eye-Catchers at Plant Maintenance Show . . .

- **CONVEYOR TROLLEY WHEEL LUBRICATOR.** A flip of the switch and it goes to work. Made by Alemite Div. of Stewart-Warner Corp., 1826 Diversey Pkwy., Chicago 14. Lubricates every wheel on both sides of the track without stopping the line. Each wheel gets an exact shot.

- **PORT-A-PONY** for power-threading pipe. Weighs only 26 lb. Takes one hand to operate, which leaves the other free to oil the die. Thread-Ezy Mfg. Co., 324 Shiawassee St., Corunna, Mich.

- **CMU,** a weed and grass killer. Good wherever vegetation is a nuisance or an eyesore, a fire hazard, or a maintenance problem. E. I. Du Pont de Nemours & Co., Grasselli Chemicals Dept., Wilmington 98.

- **DEXANGLE,** whose use is limited only by your imagination. Make your own shelves and bins; work tables, benches, ladders; supports for plumbing, conduit, overhead conveyor or lines; guards for machinery; carts, trucks, special materials handling equipment. It's galvanized steel angle, slotted along its length for quick joining and assembly with ordinary bolts. Acme Steel Co., 2840 Archer Ave., Chicago 8.

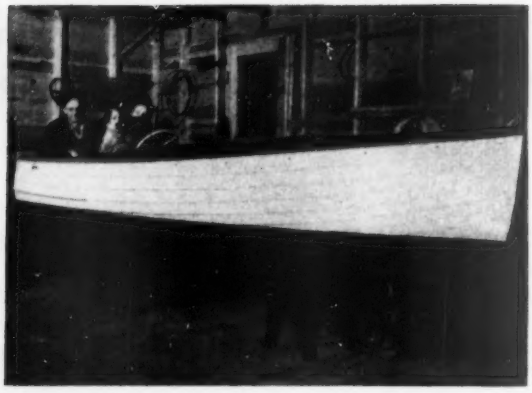
- **COSMOLUBE,** for cold, hot, and wet spots. One grease to stock because (says its maker, E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia) you can use it across the board.

- **PLASTILUBE,** another miracle lubricant. Tops for lubricity, adhesiveness, and pumpability (according to the maker, The Warren Refining & Chemical Co., Cleveland). Never melts, resists water.

- **GRIP-STRUT,** a revolutionary safety grating. Aluminum or steel. Great strength, minimum weight, non-skid. It's all one piece of material, not expanded, but slit and folded to get a diamond-shaped pattern. Grip-Strut Div., The Globe Co., 4000 S. Princeton Ave., Chicago 9.

- **SHOPMOBILE,** a mobile workshop for maintenance men. Details and photos on page 162.

CHRISTMAS SAVINGS have piled up for Ralph Myers.



PROFIT SHARING bought this boat for George Elish.

HOME LOAN by company helped Jim Lewis buy farm.

SUCCESS STORY: Gorman-Rupp's free-wheeling formula for . . . Good Employee

Gorman-Rupp people call it "fraternalism," insist it's *not* paternalism. They feel their smallness is an asset, permitting an unusually complete employee-relations program. They say they can do *more* than big companies.

They may be right. But we feel that even a big-company executive can get a real lift out of this small-plant employee-relations success story.

JUST TWENTY YEARS AGO, on March 1, 1933, the Gorman-Rupp Company began operations in Mansfield, Ohio, with a net worth of $1200, no product to sell, and one employee.

Today the company has a net worth of some $1¼-million. And its 180 employees turn out a complete line of self-priming centrifugal pumps in a tidy and newly expanded plant.

As the company has prospered, so have its employees. Wages are high—equal to tops in the area. And more than $1-million has been distributed via a profit-sharing program since 1935.

But there's more to it than wages and profit-sharing. There's a free-wheeling, friendly work-

RECREATION FIELD for employees serves the kid leagues, too.

"FRATERNAL POLICY" lets Chuck Watson fix car in shop.

INFORMALITY lets George Norton grow plants by bench.

Relations in a Small Plant

ing atmosphere in the shop that you feel almost as soon as you step inside. There's a remarkably complete employee-relations program—the kind that most small plants tell you only the "big guy" can afford. And there's a simple but effective management philosophy of fraternalism (*not* paternalism) that makes the whole thing work fine.

Benefits to Company

Best thing about this is that it turns out to be good business. For example:

Competition indicates that man-hour output at Gorman-Rupp is high for the industry. Costs are correspondingly low, say company officials.

Quality of workmanship is excellent—enough so that the company sells its products with a no-strings attached, unconditional guarantee.

Labor turnover for all reasons is very low. Last year it was 6% for the entire year, or ½ of 1% per month! Moreover, management has fired or laid off workers only once—when the men in the shop petitioned the company to let two men go.

The company's reputation is becoming legendary in the Mansfield area. Files of job applications include more names than are now on the Gorman-Rupp payroll.

Turn the page

Employees really work for higher profits. In a recent expansion, for example, they chose to do the building themselves—all except the structural steelwork—and saved about $150,000.

Company Attitude

Basically, Gorman-Rupp's idea is that investing in employee well-being is good business. The idea is not that workers are expected to *thank* the management for benefits or high wages. On the contrary, what's aimed at is to give workers the chance to pay back in full for what they earn while at the same time enjoying their work in congenial surroundings and with congenial fellow-workers.

More specifically, here are some of the main principles underlying this company's program:

1. Competition largely fixes selling price, but it's your own employees who determine your "making price." So it makes sense to do all you can to make your employees anxious to see the company turn up a profit year after year.

2. Employees will work hard to increase company profits, if given the opportunity. So it makes sense to give them that opportunity by sharing the profits with them.

3. The informal, friendly shop is the efficient shop. So it makes sense to encourage informality and friendliness—but not laxity.

4. Personal interest in employees and their problems is essential. So it makes sense to foster such interest among management people—but never to go so far as to snoop into workers' private lives or try to dictate to them. (That's paternalism, and it doesn't work.)

5. You must build on a solid foundation to get results with any employee-relations program. So the first step must be to satisfy basic employee desires—to provide the family with reasonable comforts, educate children, be secure in old age.

Company Practice

The big problem for Gorman-Rupp, as for any company, is to practice what it preaches. This company does, in literally hundreds of ways, mostly small. Here are 15 specific examples. Some are costly. But others just take the time and patience and interest to think them up and put them into operation.

1. PROFIT SHARING · The plan started in 1935—with 22 employees. Regular employees share in a portion of each month's profit. Beginning the third month of a new employee's service, he shares on the basis of 10% of the amount pro-rated to the month. The fourth month he shares 20% and so on until in the 12th month, and thereafter, he participates in full. Employees get their shares at an annual Christmas party.

2. INFORMALITY · Easy-going informality, *but not laxity,* is characteristic of company operations. Little privileges, like George Norton's flower growing (picture, page 103) are granted as long as they don't interfere with work.

Gorman-Rupp works only limited Saturday schedules because many employees are landowners and like full week ends for themselves. And they push hard during the week to get their work out. Hourly wages are paid. No piece work. No wage-incentive plan.

3. COMPANY COOPERATION · Following a "fraternal" concept of plant operation, the company has made its tools and shop facilities available to all employees. After hours they can carry on hobbies, and do "home jobs" right in the shop.

Tools and materials are accounted for on a simple requisition form, and may be borrowed overnight. No charge is made for the use of equipment in the shop or portable tools like electric drills, pipe tools, shovels, and so forth.

Materials can be requisitioned and paid for by individual employees. This includes pipe, lumber, metals and other materials normally available in the plant.

4. CHRISTMAS SAVINGS CLUB · To be sure each employee has ready cash available at Christmas each year, Gorman-Rupp operates a savings club. It matches—to a limit of $3 a month—what the employee banks in the club. Thus if an employee banks $36 a year, the bank sends him a check for $72 before Christmas. Ralph Myers, for example, let his Christmas fund money accumulate for the last 8½ years, then posed for FACTORY's camera with the resulting $630 in silver dollars. The three piles represent his contribution of $303, the company's contribution of $303, and interest of $24. Most employees withdraw their savings annually, but some—like Ralph—prefer to let them pile up.

5. RECOMMENDATIONS · The company recognizes that congenial people work together better. So applicants are accepted for employment only after they've been recommended by three employees. A result has been the development of a friendly shop, where even the newest worker feels he's accepted.

6. HELP IN BUYING NEW HOMES · Because Mansfield is in the heart of a rural area, company officers encourage employees to own their homes and 40 to 50 acres of land. That way they have a larger stake in the community—and in the United States, too.

for that matter. Loans are interest-free. Repayment starts at the end of the first year. Company officers also lend a hand in finding suitable properties for employees.

7. PROMOTION-FROM-WITHIN • Job openings are advertised on the plant bulletin board. Notice tells nature of the work, starting rate, and the top rate for the job. Seniority is recognized among applicants with ability for the job.

The plan isn't restricted to shop jobs, either. Recently, for example, two office department positions were offered on the factory board. The jobs were promptly and acceptably filled from within. The men like this, and so does the company.

8. WORKER REPRESENTATION • There's no union at Gorman-Rupp. But in a shop where there's high morale, no layoffs, profit sharing, and retirement and other benefits, a worker might be reluctant to voice a personal problem, so the company voluntarily recognizes a works committee. All members are hourly paid workers. Employees elect one member. The company selects one. And the third is chosen by the first two.

The works committee is an accepted and respected two-way channel of communication between management and employees. It is a suggestion service to management and acts for improvement in working conditions and employee happiness. It offers a counseling service for employees and talks for the employee who prefers to have others talk for him.

9. ORGANIZED CHARITY • Welfare and charity campaign solicitations are problems for employees in many companies. Gorman-Rupp employees solve theirs with a civic fund. Through it they give as a group to organized charities, send flowers to employees, and have some left over for fun at picnics. A committee of seven, elected by all employees, administers the fund. Money comes from a three-mill contribution of the gross earnings of each participant. (Participation is 100%, by the way.) Still more money, about $1500 yearly, comes from the profits from an array of vending machines.

One more provision of the fund: If an employee needs help badly, he'll get it, in one form or another from the fund.

10. SOCIAL ACTIVITIES • For example: The company picnic is a family affair held each summer. Employees form committees to handle details. Company provides park facilities, meat, bread, butter, coffee, orangeade, beer, plates, cups, and rides for the kids.

Christmas parties are all on the house. Wives receive presents (blankets, cookware, etc.) from the company, men get their profit-sharing checks.

And there are three other get-togethers annually. At these gents and ladies meet separately, enjoy food, drink, and cards. Everybody goes, has fun.

11. EMPLOYEE RETIREMENT TRUST • Age limits of the trust are 25 to 55 years. Qualifications are regular employment and five years of service. Formula is 1% credit for each year of service applied to the employee's average monthly wage. Maximum monthly benefit is $125. The company pays all costs of the vested plan—which is independent of, *and in addition to*, social security. Optional settlements are available on retirement or withdrawal.

12. RECREATION • Just behind the plant is a recreation field, considered to be one of the best-lighted in Ohio. It's a regulation ball field, with bleachers, a refreshment stand, and protective screens. Employees participate in—or watch—softball, baseball, and soccer. Their kids can use it, too. In addition, it's available to the city recreation department and other groups. Gorman-Rupp owns and maintains the field. For the protection of users the field is heavily insured.

13. REWARD FOR SERVICE • Like most companies, Gorman-Rupp has paid vacations. And as a reward for continued service, 15-year employees get three weeks off with pay. Some employees prefer not to take vacations, so the company pays them their vacation money and regular wages for the vacation time they work. One-year employees get one week, two-year employees two weeks.

14. INSURANCE PROTECTION • Gorman-Rupp employees are covered by several kinds of insurance. Workman's compensation is, of course, required by law and paid for by the company. In addition, the company covers all employees, at no cost to them, with off-the-job insurance. Indemnity payments of $20 weekly for 13 weeks are allowed for disabling sickness or accident after the first eight days. A 31-day, $9-a-day hospital allowance is included. Up to $200 is allowed for surgery, and up to $180 for miscellaneous hospital expenses. This insurance covers the employee's family, and provides maternity and obstetrical service. Standard Blue Cross plans are also available.

After three months' service, new employees become eligible for group life insurance. Employees may subscribe at 60¢ a month per $1000 of coverage and are entitled to $2000 coverage. The company pays the remainder.

15. COMPANY BOOSTS EMPLOYEES • There's a "we're proud of you" word wherever possible. For example, at a recent local industrial exposition, the Freedom Fair, Gorman-Rupp made its employees the big feature of the company exhibit. Big backlighted display panels carried head-and-shoulder positive-transparency portraits of all employees and photographs of their homes, hobbies, and avocations. Spectators' interest at such displays is always high because community members are interested in their neighbors.

Take this test . . .

Rate Your Production Control

1. Does it really have management backing? Are decisions of arbitration between production departments and production control made without bias?

☐ Excellent ☐ Good ☐ Fair

2. Is it manned by capable personnel? Were they selected and trained to perform an important job requiring knowledge of production and control practices?

☐ Excellent ☐ Good ☐ Fair

3. Are its reports to management accurate? Do they reflect a true picture of completed work and the status of work in process?

☐ Excellent ☐ Good ☐ Fair

4. Does it maintain a free flow of work through the plant? Or are there interruptions for which production control is responsible?

☐ Excellent ☐ Good ☐ Fair

5. Do you have high cost variances for extra setups and overtime?

☐ Excellent ☐ Good ☐ Fair

6. Do shop superintendents and foremen work hand-in-hand with production control? Or do they complain about poor service and cooperation?

☐ Excellent ☐ Good ☐ Fair

7. Does it do an effective job on inventory control? Or is inventory control only card-keeping with frequent out-of-balances showing up?

☐ Excellent ☐ Good ☐ Fair

8. Are its schedules usually met? Or are they frequently off with impractical estimates of time and materials?

☐ Excellent ☐ Good ☐ Fair

9. Does it actually control input? Or is it simply told what orders to process by another department?

☐ Excellent ☐ Good ☐ Fair

10. Does it have a fast and accurate communications system?

☐ Excellent ☐ Good ☐ Fair

11. Do its reports come out promptly? Or are they late for effective remedial action?

☐ Excellent ☐ Good ☐ Fair

12. Are shipments made on time? Or are there too many customer complaints about broken promises?

☐ Excellent ☐ Good ☐ Fair

and read this article * for an answer to . . .

How Good Is Your

I DON'T KNOW what I'd call a passing grade for this test (left). But—if you have no "excellent's," or a number of "fair's," I suggest you give some thought to how you can improve your production control. And, to help you, I've set down here what seem to me to be the minimum requirements for *really good* production control.

What is good production control?

Basically, the concept of production control is extremely simple: Control in a small plant devoted to soft-drink bottling, for example, differs radically from that exercised in an automobile assembly plant. At the bottom of both, however, are the same principles of planning and control — principles that evolve from and center around the flow of material peculiar to a given process.

Each plant has its own particular routes or paths over which material moves, determined in large measure by the design of its end-product. A clear understanding of the nature of this flow is necessary in any concept of production control. Before anything can be controlled, it must be known. The production specialist must know his own manufacturing flow. Knowing the physical route taken by work-in-process is essential. But that's not enough. He must know the behavior of the work stream. A lot of factors besides work flow determine whether production moves or stops.

Fluidity of movement, this steady transformation of raw material to finished end-product, is vital. It must be planned in advance, activated, and kept moving. This is the job of production planning and control—to plan the flow in an intelligent manner and in the "one best way"; and to see to it that all things happen as planned. The more accurate and detailed the planning, the easier the control.

Work load data, for example, are realistic; schedules, consequently, are attainable. Each day's work is planned; the flow moves forward at a steady pace. Inventories are known quantities; ordering is in phase with consumption and economy. Manufacturing cycles are worked out in de-

* Based on the author's production experience prior to joining his present company.

Production Control?

By ERNEST J. LAMBERTI • Industrial Engineer
Federal Telephone & Radio Corporation
Clifton, N. J.

tail; guesswork on starting time is eliminated. Routing is well thought out; transportations, backtracking, delays are minimized.

Where planning is loose or non-existent, control is vague and the shop is generally in an uproar.

Of course, a lot of data and high degree of planning don't insure good control. Plans must be converted to action, energized by people. Plans, reflected in clear-cut, detailed, attainable schedules, must get down to the shop level. The foreman, his hands full taking care of his men, machines and tools, and concerned with getting the work done, must be presented with his day's work. Too often a busy foreman spends the major portion of his time at his desk in a planning function that is seldom well done because he's needed in the shop, where he should be in the first place.

Input must be controlled. Reporting must be timely, fast, and accurate, and a constant measure of performance against schedules. Failures must be investigated at once and remedial measures taken.

How can you have good production control?

Management must be first convinced of the need to plan and control the manufacturing program. There is no argument here for the alternative to control—disorder and high costs. What is surprising, however, is that many managers know what they want but often don't take the steps to get it.

The first step, of course, is staffing the production department with capable personnel—people who if they are not already expert are at least mentally and physically qualified for training in production.

Also, management must see that the people concerned with planning *have the time* to do it.

Not enough people, not enough time, causes "fires" in production control. Takes effort to put them out, leaving still less time for planning.

A most important factor in the success of production control is training and educating. *All* departments concerned—and this includes almost every group in the plant—should be alert to the need to maintain the flow of work and materials. A drafting error on a blueprint may be of little concern to the draftsman who made it unless he realizes the cost of production. A sales department may promise customers the moon with little thought to what has to happen in the factory. A toolroom supervisor (traditionally independent!) delays in delivering a die—and a job is deferred because he did not take seriously the time-table given him.

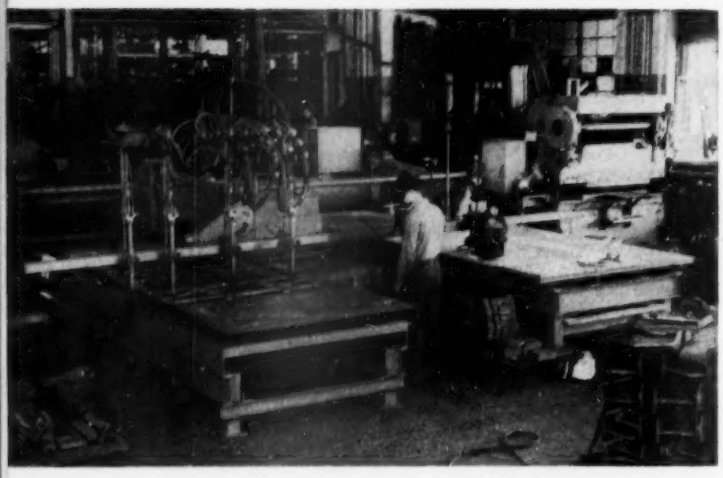
So far I've said nothing of such things as planning boards, machine loading equipment, charts of all kinds, and the various other devices that usually make up the paraphernalia of a production group. They were purposely left to the last because of the tendency of many, including production people, to build their concept of control around such devices, mistaking the principles of their operation for the principles underlying the real nature of production planning and the exercise of production control.

In fact, it's quite possible to effect good control without machine loading boards under certain conditions. Such may be the case where the manufacturing operation is small and simple, and especially where the very nature of the end-product lends itself to automatic processing.

Mechanical devices, in production work, must be looked upon as aids. Particularly are they helpful in keeping track and recording the progress of numerous parts—to keep them in their proper place in the work flow. They have a very definite psychological value in posting for all to see what has to be done and what is being done—a stimulus to interest and morale. In an operation of any size and variety, then, such devices become a needed tool. It should be noted, however, that the form these tools take must be, for full effectiveness, suited to the operation for which they are to be used and keynoted to simplicity. There is no one master production set-up to be copied by all. On the contrary, those that seem to work best have been tailor-made to the requirements of an individual plant by personnel thoroughly familiar with the characteristics of its work flow.

Each plant must build its own control organization based, I feel, on the principles stated and adapted to its own type, variety, and quantity of end-product, functional organization, and other factors which make one plant differ from another.

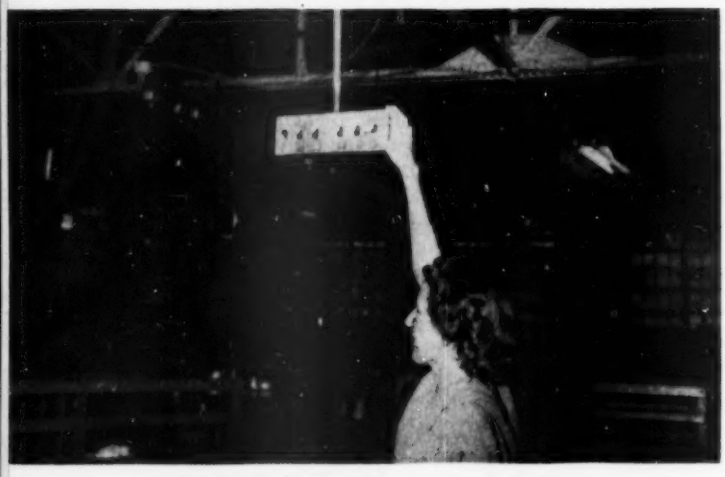
OPERATING SHORTS



Electric Eye Guides Steel Cutters

A new electronic tracer uses up to four oxy-acetylene torches to flame-cut plate-steel parts from an ink-drawn, glass-cloth templet at the Thew Shovel Company, Lorain, Ohio.

An electric eye follows the pattern on one table (right) while arm-connected torches cut on a parallel table (left). Thew says the electronic method holds to closer tolerances than hand cutting, thus results in stronger fabricated parts.



Signal Lights Summon Mechanics

When a machine breaks down, you can lose a lot of production time while someone goes hunting for a mechanic to fix it. E-Z Mills, Inc., Cartersville, Ga., speeds repairs with maintenance signal lights.

The lights are mounted on a central board and controlled by switches at convenient points in the plant. Color of light shows the type and make of machine. Its location on the board indicates the machine's location on the shop floor. When a breakdown occurs, the operator simply flicks a switch to signal a mechanic specialist on that kind of machine.

'Railroad' Speeds Aircraft Output

U. S. Air Force and Navy jet trainers are "railroaded" through production at Lockheed Aircraft Corporation, Burbank, Calif.

Block-long trains of wheeled assembly jigs are pushed along rails by a midget tractor. Every 3.2 hours, they're moved up one station on four 13-station production lines. With the tractor, Lockheed can advance two trains in 3 minutes. Previously this was a 1-hr. job for four men.

The picture shows one train of assembly jigs being pushed up the line (right) after another train (left) has already been moved. Detachable couplings hook jigs together.

Angled Installation Saves Space

Half again as much usable floor space in the same size area. That's the advantage of installing drop hammers at a 45-deg. angle to aisles in Rohr Aircraft Corporation's new Riverside, Calif., plant.

The photo shows four of six Rohr-designed hammers being put in place. On-the-bias installation permits loading and unloading of dies and punches with a die loader. Formerly an overhead crane was used for this work, to avoid cluttering aisles.

Another space-saver: racks for spare trip-ropes atop hammers instead of on the floor.

Disk in Tube End Cuts Paint Loss

Problem · How to cut the loss of paint through the open end of a 5-in. rocket tube while the inside is being painted.

Solution · A perforated disk fitted into the tube end. The disk has enough vents to permit proper paint gun pressure. It assures adequate paint coverage without excessive paint loss.

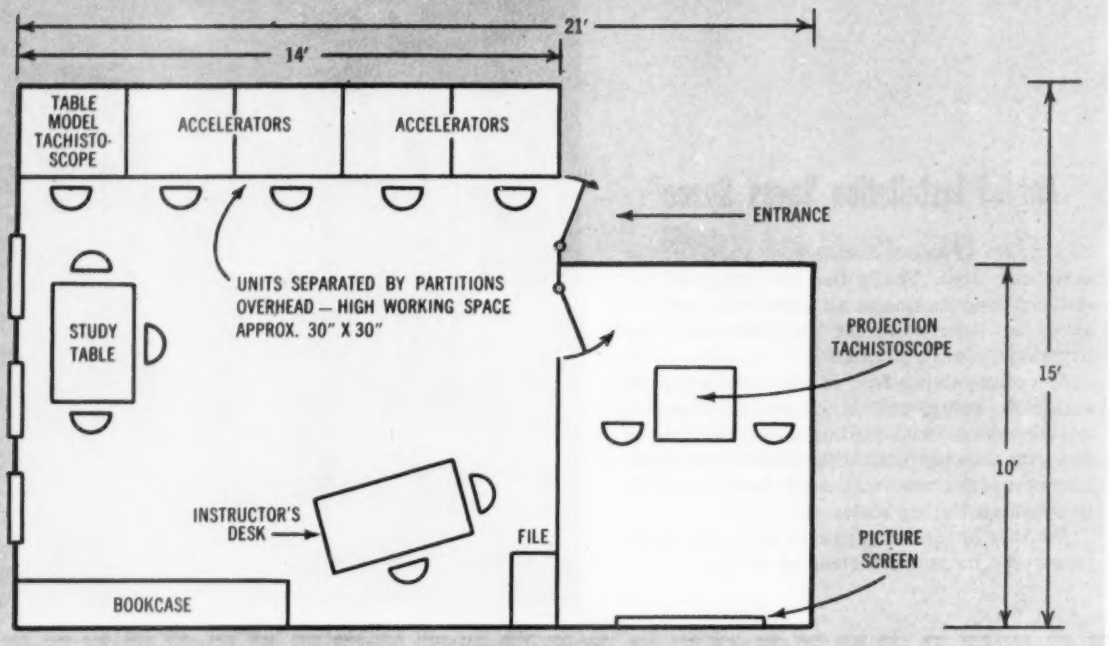
The idea won a $900 suggestion award for two employees (shown here) of The Firestone Tire & Rubber Company's defense products plant, Akron. At left is a disk in a tube, at right an open-ended tube.

Tower Thwarts Parking Lot Thieves

Thefts from employees' cars have stopped since Warner & Swasey Company, Cleveland, erected a watch tower in its parking area.

The 40-ft. structural tower is manned around the clock. It's topped with a glass-walled, insulated booth that houses a telephone, small radio, and heater. Mounted 5 feet above the booth, 14 wide-beam, 1000-watt floodlights and 4 narrow-beam, 1500-watt lights cover all parking lots during dusk and darkness.

Total cost was $10,000. Up to 750 cars are parked in the area throughout three 8-hour shifts.



FOR BASIC TRAINING Micro used this "reading center." It was set up on a temporary basis for four weeks, then restored to regular use. Room accommodated groups of four men, enabled instructor to give each man individual instruction.

Another way to cure briefcase-itis*:

In-Plant Training for Better Reading

Here's the story of how 26 key executives learned to read faster and better right in their own plant—in a remarkably short time, and with a minimum of upset to work and production schedules.

Looks like formal reading training right on the premises may be a lot easier and more practical than you may have thought. At any rate, Micro is one company that certainly thinks so.

*See also "How to Read Faster and Better," FACTORY, October 1951, p. 84.

TWENTY-SIX of our top-level and second-level executives have just finished an in-plant reading course. It took one hour a day for 20 consecutive working days. And it took another dozen hours for "before-and-after" tests and counseling. But we don't regret those 32 "lost-time" hours. We know we'll get them back—with interest.

Results

Let's take a look at the record—to see why we're so sure we've made a good investment:

The most valid measure of results is to compare the average low scores for our first five training sessions with the average best scores for the last five. On that basis:

For detailed reading, we showed an improvement in reading rates of 69%, with a 15% increase in comprehension.

For general reading, we showed an improvement of 98% in rate, with no loss in comprehension.

Of course, not all people have the same reading difficulties. Our course was tailored to fit individual needs. Tests given prior to the course showed

FOR FOLLOW-UP Micro bought reading accelerator and tachistoscope. Course grads may use them for further practice.

By JAMES S. MASSIE • Staff Assistant
Micro, Division of Minneapolis-Honeywell Regulator Company
Freeport, Ill.

that some men needed help with the *total* reading process—rate, comprehension, and vocabulary.

This group showed a 67% gain in rate, a 118% gain in comprehension.

The group that needed help mostly with comprehension showed a 48% gain in comprehension, along with a 14% gain in rate.

The group that worked most on rate and vocabulary showed an 80% gain in rate, with a 9% gain in vocabulary (remember, vocabulary is not something that can be improved quickly). The group that needed help with rate alone (this group was at a high level of reading skill to begin with) showed a 51% rate gain, along with a 2% gain in comprehension.

We think those results justify the time and money we put into the course many times over.

Here's a typical reaction from an executive with a technical background:

"Engineering courses of study, by reason of the high mathematical and technical content of written information, tend to produce the habit of slow and meticulous reading. This habit is easily carried over into the reading done in keeping up with current technical literature as well as into reading for pleasure. I'm convinced that the reading course is successful in breaking these habits to a degree that will permit reading rates consistent with the type of reading material, as well as teaching faster reading habits for all types of material. Obviously, in an activity where reading and action prompted by written material constitute a high percentage of the day's work, such benefits result in increased productivity."

How the Course Was Started

This was not a top-management-dictated affair by any means. The idea was sparked at a luncheon table gripe session over the seemingly unending volume of correspondence, inter-office memos, trade publications, and other written material that had to be read and digested.

We put the idea of reading training up to top management, as a possible solution. They approved the idea and offered to pay half of the basic cost (plus all other accessory expenses— i.e., traveling and living expenses of instructor, etc.) for any executive interested enough to put up the other half. A good idea. It encouraged only those who were really interested—and it gave us a real stake in the outcome. (Fee for course we selected was $75 per man—company and participant each paid half.)

I was assigned to the job of selecting a suitable source of outside help. After making a study of the several courses available, we selected the one given by the Reading Service of the Institute for Psychological Services at Illinois Institute of Technology.

Opening gun was a luncheon meeting at which Mrs. Elizabeth Simpson of the Reading Service gave us an over-all explanation of adult reading habits, and told us why training in better reading is a practical approach to improved executive efficiency. She was barraged with questions:

"Can I learn to do it myself?" Her answer: "Sure you can. But, like learning anything else, you get along faster if you have help."

"Won't I lose comprehension with increased speed?" Answer: "No. Accelerated reading means thorough reading at increased speed—not skipping words. What you really learn is how to shift gears—change your reading speed with the type of material and your purpose for reading it."

"How does vocabulary tie in, and can it be improved much in 20 lessons?" She told us: "You can't read effectively if you're always stumbling over words you aren't familiar with. No, you may not show a big improvement in vocabulary in 20 lessons. (One of the groups showed a 9% gain, you'll remember.) But the course will teach you the techniques needed to improve your vocabulary on a continuing basis."

And so on. On the basis of the interest shown at this meeting, we got rolling. *Turn the page*

How the Program Worked

There's no point in going into minute detail, since reading training programs will vary with the organization or person doing the training. But here's a brief run-down, with enough detail to give you the "feel" of our experience:

1. Each of the 28 men in the group (two later dropped out) took a "diagnostic reading examination." We went on a scheduled basis to the offices of the Reading Service at Illinois Institute of Technology in Chicago. The testing took a whole day for each man. There were two reasons for the tests: (a) To set up "before" figures for a before-and-after analysis of the training results; and (b) to determine each person's individual needs.

Incidentally, the test was about the hardest day's work any of us had put in in a long time.

2. Back at the plant, each man was given an analysis of his test results. This was done in private interviews. We saw the test results and our individual profile, showing us how we stood. We also got some counseling on the best course of action each of us should follow in licking our individual reading problems.

3. Then Mrs. Simpson broke us up into seven groups of four men each. She picked for each group men with similar types of reading problems and similar levels of reading skill. That way, each man in each group got his fair share of individualized instruction.

4. Each group met with the instructor, Dorothy Poling, for one hour a day, five days a week, for four weeks. That was the course—20 hours, spread over about a month. Since there were seven groups, this plan kept the instructor plenty busy. She had just an hour for lunch, with the other seven hours of each day spent on instruction.

Though it was tough on the instructor, this plan was excellent from everybody else's standpoint. The small groups enabled each of us to progress at his own pace. The daily schedule didn't take anyone away from the job too long—nor did it take many men away at any one time. And we finished up the whole project fast. It's about the only way we could have handled the training of such a sizable group without having to leave the plant, and still have all the benefits of individual instruction, tailor-made to our needs. While the idea is not unique at all, it's a good pattern to follow for training of this type.

5. We received instruction in a temporary reading training center set up right in the plant. The layout of this room (page 110) was a real asset to the instruction, we all thought. Plywood dividers between positions at the long table that was used for the basic equipment (top of layout) set gave us freedom from distraction as we worked with the reading accelerators or the individual tachistoscope (rapid-exposure device to increase reading span).

There was also a projection tachistoscope that threw groups of numbers and words on a screen to give further practice in seeing more with every glance. This was separated from the rest of the room by a temporary partition. All the training and testing equipment, by the way, was supplied by the Reading Service.

The physical set-up was only temporary, so it wasn't expensive (actually it cost us $90 to set it up). And it was certainly worth while in giving us the most for our time. Any room, practically, will do if it's reasonably quiet. And, though it's only for a short time, it's worth fixing the room up. Then your instructor can work at top efficiency.

6. At the end, we again took all the reading tests we took before the program started. That provided the "after" for before-and-after comparisons and gave a good picture of the progress we had made.

In addition, each of us again conferred with the instructor. She reviewed our progress, and suggested further steps that we could take on our own to continue self-improvement.

We're Now Following Up

At the end of the course, our management deemed it advisable to purchase a tachistoscope, an accelerator, and reading material (total cost, $215). We set this material up in our personnel office so the men who took the course could, on company time, undertake a "self-improvement reading course" whenever they found themselves with a free moment. This equipment will not be available to men who did not take the course for two reasons:

1. Some of the reading material does not lend itself to self-improvement without prior reading instruction.

2. The company is considering setting up another course for other employees, and since this material would be used, any familiarity with it would color test results.

About two months after the completion of the course, Mrs. Simpson made another trip to the plant to counsel those men who wished help with this self-improvement work. That was a great help. We recommend it to anyone undertaking such a program.

And the final step will be, at the end of the six months, a re-test of the men to check on their continuing improvement. We feel sure, on the basis of talking with the men who took the course, that there will be no regression. Rather, because of their continuing interest and use of the self-improvement equipment available in the plant, we look for continuing improvement in reading speed and comprehension.

HAROLD E. BLISS is *not* a "maintenance man." He's a CPA whose company assigned him to install a maintenance cost control program. So, instead of operating out of an ivory tower, he moved his desk right down into the plant engineer's office. And there he learned about plant maintenance, applying his knowledge of systems to the facts so well that Lukens has saved about one-third of its maintenance bill.

How to Find and Control Your Maintenance Costs

By HAROLD E. BLISS • Assistant Controller, Lukens Steel Company, Coatesville, Pa.

CONTENTS:

1. PLAN YOUR PROGRAM CAREFULLY, PAGE 115
2. ADOPT SOUND MAINTENANCE POLICIES, PAGE 118
3. BUILD A GOOD ORGANIZATION, PAGE 119
4. SET UP ADEQUATE EQUIPMENT RECORDS, PAGE 122
5. KEEP EQUIPMENT RECORDS UP TO DATE, PAGE 125
6. REGULATE PURCHASE OF NEW FACILITIES, PAGE 127
7. GET THE COST OF EVERY JOB, PAGE 129
8. KEEP TABS ON MAINTENANCE PARTS, PAGE 133
9. DEVISE AND STUDY EXECUTIVE COST REPORTS, PAGE 134

FACTORY MANAGEMENT AND MAINTENANCE • Plant Operation Library No. 145 • March 1953 • Copyright 1953 by McGraw-Hill Publishing Co. Inc.

Do you think you're paying too much for maintenance?

Are you satisfied that the maintenance set-up in your company is fully effective? Is it really paying its way—keeping costs down, reducing machine repair time, and maintaining your facilities in tip-top shape?

Does your system of maintenance records help control maintenance operations? Does it provide answers—quick—about the cost of individual repair jobs? Does it tell you the number of times a machine has been repaired, and the cost—last month, last year? Can you pinpoint the high-cost machines or functions and give the reasons why?

When we at Lukens Steel Company asked ourselves these questions three years ago we were not satisfied with the answers. That's when we decided to take action to overhaul our maintenance set-up.

OUR OBJECTIVES • (1) To improve maintenance service; (2) to control and reduce maintenance costs.

OUR PROBLEM • How to revise our maintenance set-up and realize our objectives in a reasonable period of time without interrupting the normal flow of maintenance activities.

OUR SOLUTION • A long range cost-control program, designed to attack and overhaul each segment of the maintenance function—in logical sequence.

THE PAY-OFF • To date we have been able to:

1. Transfer 162 wage and salary maintenance employees from maintenance functions to other departments.
2. Reduce material costs.
3. Simplify paperwork, reduce clerical cost, speed performance of maintenance jobs, facilitate flow of information to secure prompt action. For example: Work-order forms have been reduced from fifteen to one; annual volume of forms from around 40,000 to less than 18,000.
4. Save foremen's time. They are able to spend more time supervising and less time on paperwork.
5. Minimize delay and downtime on productive facilities resulting from emergency maintenance work and breakdowns.
6. Create a more flexible and better coordinated organization structure. This has eliminated overtime resulting from the former inflexible organization.
7. Coordinate maintenance more effectively. Maintenance jobs are planned, priorities are established, and flow of work is expedited. Men can be quickly and effectively moved to trouble spots or to overloaded departments.

While these are significant benefits, you will see further on why we expect added benefits in the future. You can sum them all up this way:

Today our maintenance employees and management say that they would not go back to old methods. More important, they are suggesting further extension of the program and improvements in details of the basic plan.

OUR BASIC APPROACH • The maintenance function in any plant is a complex one. Many factors have a direct influence on repair and maintenance costs. You can't make a change or a new move until you weigh its effect on every factor.

Before all else, I want to make one thing clear. We had to do this job in a definite order. Any change in that order would have brought confusion and mediocre results. You don't put the roof on a building until you have the structure. Before you have the structure, you need the foundation.

Our program involved nine main steps. We'll present them to you in their proper sequence, and discuss the principles motivating each one.

Plan your program carefully

You can't lick your maintenance problems by using a piecemeal approach.

Each work step must be planned, each contingency considered, and alternate courses of action provided. Don't confuse unimportant details with the truly significant elements of the problem. Put the important elements first, arrange them in logical sequence and relationships so the program will always move forward and you won't have to backtrack. As an example, we planned . . .

. . . **how to approach the problem.** We determined what objectives should be established—what management wants and the company really needs—what departments, functions, or areas should be included, and the detailed work steps necessary to insure complete coverage.

. . . **how to get the facts about the existing situation.** We planned the general techniques to be used in each segment of maintenance, such as surveys, flow charts, and work distribution analyses.

. . . **how to sell the solution to all concerned.** This meant line-level personnel, operating and maintenance supervisors, and plant management. The ultimate success of all the rest of our planning hinged on this step. Why? Because people generally resist change. It's human to object to something new and unfamiliar. Change generates fear, distrust, and sometimes violent opposition. For these reasons we made certain that each person concerned was sold—that each understood why a change was proposed, and what it would do for him. We recognized this: If people participate in a program, help plan the improvements, and have an opportunity to approve the final result, you'll achieve your objectives. A plan or system does nothing by itself. People—and only people—vitalize it, give it purpose and force, and make it effective. We cannot emphasize this point too much.

But you may protest, this approach takes too long. Sure it takes longer than a haphazard approach. Enlarging on our earlier building analogy, every engineer knows that it takes much longer to produce a completely engineered building plan than to prepare a rough sketch. But he knows, too, that all you'd get from the rough sketch would be a jerry-built structure.

We planned to spend from three to five years making our cost control program fully effective. The results to date speak for themselves.

ORGANIZE TO DO THE JOB

How did we do this? At Lukens we organized by using the "committee method." It's a management philosophy here to get men together who are familiar with all facets of a problem.

Our committee, appointed by the management, represented the principal areas affected by maintenance. Because it was made up of middle-echelon management it had easy access to all levels of line and supervisory personnel and could make the decisions necessary to get action. The basic committee consisted of the following:

Title	To Represent
Assistant Controller	Finance and Accounting
Manager, Construction and Maintenance	Maintenance
Industrial Engineers, and Manager of Estimating	Operations
Consulting Engineers	Company Management
Manager	Production Control

This committee is still active in guiding our long-range program. From time to time operating and maintenance employees of all levels join the committee when it discusses problems relating to their departments. The result: broader employee participation—lots of gocd ideas—a solid background of factual information, and most important, complete cooperation.

The committee's function has been to guide and direct the program until it is completed. These are its responsibilities:

1. **Set the limited and long-range objectives.**
2. **Establish the scope of the program,** develop the work plan. Schedule, coordinate, and expedite all segments of the program. Assign the work and evaluate results.
3. **Make or initiate policies** or recommend them to management.
4. **Accumulate, receive, correlate, and evaluate data** to provide basis for action or recommendations.
5. **Design ways to correct undesirable conditions,** and test them until "bugs" are eliminated.
6. **Sell the plan** to maintenance and operating personnel and to management.
7. **Supervise installation** of the plan, police its operation, and see to it that defects are corrected.

Turn the page

STUDY THE PROBLEM

We knew we had a maintenance problem. But what caused it? We studied it from these angles:

COMPANY HISTORY • Why, you ask? Because the history of a company's growth, the facilities acquired, products manufactured, and financial progress provide a basis for assessing existing and projected maintenance requirements.

The existing maintenance policies and methods are, in many instances, the product of traditions, concepts, and habits developed in prior years—many times beyond the memory of the oldest employees. If you don't understand how they came into existence, why they are accepted, and specifically where they are applied, you may not be able to correct them.

OPERATIONS • Today, our operations cover nearly 650 acres. Nearly 5600 employees work in the steelmaking, fabricating and welding divisions, which are subdivided into some 225 departments.

We operate ten open-hearth furnaces and four rolling mills, plus heavy pressing, fabricating, flanging, welding, and machining departments. Our plant has nearly 10,000 facility items. Many of these can be considered over-age and require a large amount of maintenance.

MAINTENANCE ACTIVITIES • Here's a quick picture of what we found out about our maintenance set-up when we explored it three years ago.

- Maintenance was costing us 8% to 12% of each sales dollar—a sizable figure.
- Maintenance employees accounted for nearly 25% of company personnel.
- They were organized broadly into functional departments, each headed by a superintendent—for electrical maintenance, for mechanical maintenance, for construction, for fuel and steam. These superintendents reported to the works manager.
- Groups from each function were permanently assigned in the operating departments and maintenance shops throughout the plant. Central shops of various crafts were strewn around the plant wherever there was room for them.
- Because of union seniority restrictions, men could not be moved from one area to another to help in an emergency or to relieve overloaded crews. In many instances, some crews were idle while others were working overtime.
- Maintenance work in the fabricating and welding divisions was, in the main, controlled by operating supervisors.
- Each area maintenance shop and department ordered, stored, and disbursed maintenance material. Some material and spare parts were physically controlled through regular storekeeping procedures. The balance was stored through the plant.
- These methods tended to cause duplication of purchase and excess inventories of spare parts. Under these conditions spare parts and material could be damaged, lost, or used improperly.
- Paperwork originated and was largely controlled in the individual shops or superintendents' offices.
- No coordination among the shops.
- Maintenance job orders (15 different forms with an annual volume of close to 40,000) were written by both operating and maintenance employees. In addition, a large number of sales orders were handled by some shops.
- Maintenance and sales jobs were assigned to individual shops without regard to the volume of unfinished orders. As a result, jobs were held up, and in some instances productive facilities were shut down because repairs could not be made.
- There was little or no work planning and scheduling.
- Preventive maintenance practices were few.

FACT-FINDING TECHNIQUES • The techniques used to develop the facts have an important bearing on the program. If you don't get all the facts, or if you are misinformed about conditions, you may propose a solution that won't work. For that reason, use people who are experienced in fact-getting and fact-evaluation techniques. A trained and experienced systems man or management engineer will generally do the most effective job.

To develop factual data, we used a wide variety of techniques, including form flow charts, process flow charts, schematic application charts, and work distribution charts to show what everybody does, whether a line or staff function. There is no set rule for their use, but good judgment must be applied to avoid these techniques when some other method will provide the facts better and faster. You will see how some of them are used in the following description of work steps:

SET THE OBJECTIVES

You can't develop a plan of action unless you have definite objectives. Further, you need to get some ideas of the work steps required, the logical sequence for doing them, and a time schedule.

We used our main objective—improved maintenance service and reduction of cost—to name the program "maintenance cost control."

Our secondary objectives fell into two classes:

SHORT-RANGE OBJECTIVES

1. Establish a cohesive organization structure with line and staff functions, with centralized authority and responsibility. Eliminate mixed line and staff functions, such as the same person doing both repair work and paperwork. Create additional functions as needed.
2. Establish adequate facility inventory records and identification to control purchase and disposal.
3. Centralize location of maintenance shops, pro-

vide suitable building, machinery, and facilities for all maintenance functions.

4. Consolidate physical inventories of maintenance materials and spare parts, and place under control of stores department. Centralize responsibility for ordering, storing, disbursing, and maintenance of inventory records.

5. Improve preventive maintenance practices, set up inspection schedules, organize plantwide lubrication, all on a continuing basis.

6. Develop program to standardize, where practicable, small hand tools, machines, equipment, and such spare parts as gears, shafting, and belts.

7. Centralize and consolidate responsibility for authorizing maintenance work, and planning, scheduling, and estimating maintenance work orders in one department.

8. Design and install a simple job order system (using tabulating methods) to accumulate costs so that cost data will show:

(a) Cost of labor, burden, and material—and the shops responsible for the expenditures.
(b) Cost of repairing specific facilities.
(c) Reason for repairs and the cost.

9. Devise maintenance reports showing pertinent cost and operating data. Establish centralized responsibility for their preparation, review, evaluation, and distribution. Set up chart controls for significant items.

10. Improve plant engineering administrative methods—drafting room practices, filing systems of prints and drawings. Promote better liaison between maintenance and plant engineering.

11. Prepare an administrative procedures manual containing policies and instructions, flow charts, and data covering each phase of the program. Publish and give manual to all parties concerned.

Let me say a word here about the use of mechanical tabulating equipment. Many plants, particularly smaller ones, do not have it. That fact should not deter them from adopting the principles of paperwork in this program. I can conceive of plants with facilities numbered in the hundreds instead of the thousands (as at Lukens) getting the same results by clerical methods. Mechanical tabulating has saved us the prohibitive expense of many clerks. There are recording, posting, and analyzing systems for small plants that work very well. In short, weigh the benefits of each bit of paperwork against the cost of its application. Rarely will you find that each clerk doesn't release higher-paid skilled men for more productive work.

LONG-RANGE OBJECTIVES

1. Develop and install labor standards, wherever practicable, for maintenance operations.

2. Design and install department budgets, by cost and manpower.

3. Establish a job-order estimating and scheduling system to apply to *all* significant orders.

SCHEDULE ACTION

Once we had established the objectives, our next step was to determine which objectives should be completed first, who would do the work, and when each part should be completed.

In other words, you have to lay out a detailed work plan showing the principal operations, step by step, necessary to complete each objective. This approach ensures systematic coverage, logical handling of details, and the right answers. It takes longer to start the program this way. But planning, well done, prevents backtracking, doing jobs in the wrong sequence, creating friction with maintenance personnel, and disrupting their work. The exhibit below shows how we did this:

INSTALLATION PROGRAM

STEP No.	DESCRIPTION	ASSIGNED TO	SCHEDULE START	SCHEDULE COMPLETE	ACTUAL
1	Survey existing procedures on maintenance job orders (chart where necessary)	Jones	5/1/52	7/1/52	6/29/52
2	Make tentative proposal for revision	Smith	7/10/52	8/10/52	8/30/52
3	Review proposal with committee	Smith	8/15/52	8/15/52	9/4/52

2

Adopt sound maintenance policies

CLARIFY POLICIES

Sound maintenance policies, clearly defined, thoroughly understood, and firmly administered are the foundation of our maintenance cost control program. They set our course of action, define objectives, set limits of authority and responsibility, and generally serve to regulate and guide maintenance activities. They affect our maintenance operations and cost.

For that reason it's important to find out what policies are presently in force and what additional ones should be made effective. If you're like Lukens was, don't expect to always find them in published form. Many of our definite maintenance policies have been developed and accepted over a period of years. Some of your policies are the result of experience, habit, or tradition. They may not be spelled out. In fact, only a small number of employees may recognize them as company policies. These are the policies that will give you trouble. For that reason, it is important to plan the fact-finding approach carefully.

PREPARE A CHECKLIST • One approach is to prepare a checklist of the maintenance situations that should be covered by definite policies. Then investigate whether or not such policies have been established, defined, and properly administered. If some have been omitted, or are not clearly or properly defined, make recommendations for their correction.

MAKE YOUR OWN POLICIES

Don't try to adapt or apply some other company's maintenance policies to your company. They won't do the job. Policies that work must be formulated on the philosophies of your company's management. They must express management's concepts of the maintenance function's place in the organization, its responsibilities, its effect on operations, and its contribution to total company objectives and profits. You will need policies adequate to cover:

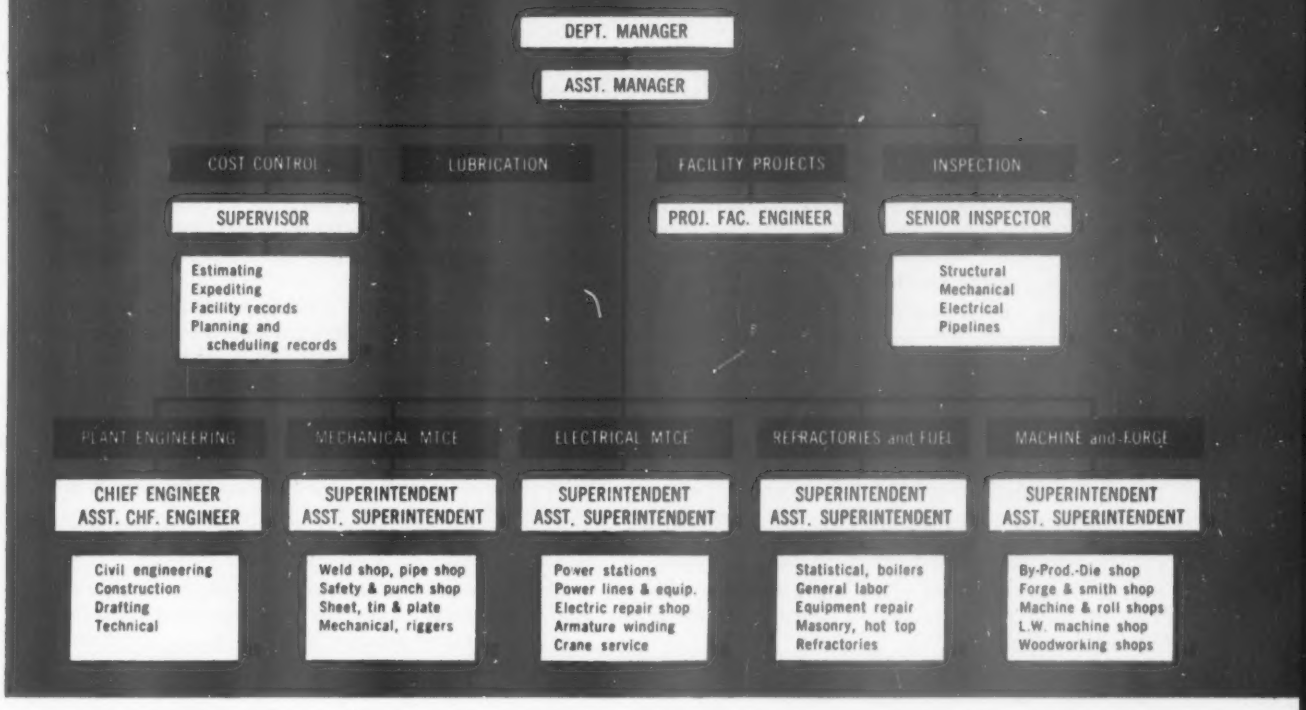
1. The place of maintenance functions in the organization. Organization structure — to whom they report—scope of responsibility and authority and relation to other functions.

2. Purchase, repair, and replacement of facilities. Under what conditions may facilities be purchased, replaced or repaired, at whose authority, and restricted to what amounts? Should repairs and maintenance be kept at a minimum so that facilities are replaced more frequently? Or should they receive the maximum attention to secure the longest useful life?

3. Accounting treatment of new facility purchases and replacements, major repairs and normal maintenance. These policies should answer the following questions: When should purchases be charged to operating cost? What basis should be used for charging off depreciation? When should they be depreciated more rapidly for book purposes than for tax purposes? What reserves should be maintained for accelerated depreciation, major repairs, replacements, etc.? How should purchases of spares, machine parts, etc., be accounted for? The answers help the maintenance executive to utilize the services most efficiently, and to maintain the plant at optimum standards.

There are many other phases of maintenance operations that should be fully regulated by policy decisions such as standardization of equipment to allow a low spare parts inventory. Some are on a company-wide basis, such as spare parts control. Others are at the department level, such as operation of cranes. Make certain that all the policies are clearly expressed, are in line with company objectives, and above all are flexible. Inflexible policies tend to "strait jacket" decisions and action.

We formulate company policies at the management committee level and publish them in letter or manual form. They are enforced by maintenance supervisors who make and put into effect department policies that implement and supplement the broad company policies.



ORGANIZATION CHART shows centralized line and staff set-up of maintenance and construction division at Lukens Steel Company. Figures indicate supervisory and salaried employees—a total of 136. The division has 1100 hourly wage employees.

3

Build a good organization

DECIDE WHAT TYPE

What type of organization is best? Line and staff? Centralized or decentralized? We can't say—it all depends on the physical aspects and operating needs of your plant.

We selected a centralized organization plan with line and staff relationship as the most promising solution. The over-all result is shown in the chart above.

WHY WE CENTRALIZED • We had been using the decentralized type of organization for many years, but it didn't produce satisfactory results. You may wonder why, because many companies seem to use the decentralized organization successfully. We found that it:

1. Prevents planning, expediting, and coordination of maintenance work on an over-all plant basis so that most important jobs are done first.

2. Requires more supervisors, clerks, and line employees to keep it operating. Employee time is not fully and effectively utilized when assigned to a single operating unit.

3. Tends to produce unbalanced work loads in maintenance shops because of lack of over-all planning. Results in greater number of partially completed and "not started" jobs in shops. Leads to greater number of delays on productive facilities because maintenance jobs are not done on time.

4. Increases spare parts and material costs and inventories; prevents centralized control of purchases, inventories, and disbursements. Encourages each foreman to order more spares or material than actually needed, to duplicate purchases by other departments, and to cache unused material.

5. Fosters "empire building." Each decentralized function tends to be self-sufficient, to plan its work, and project its needs in terms of departmental rather than plantwide requirements. Therefore, it is less susceptible to control.

6. Creates too many "specialists," not enough

"generalists." Men trained to serve single operating departments are unable to serve a wide range of functions. It's difficult to move men quickly and effectively to trouble spots.

BENEFITS OF CENTRALIZATION • Our centralized organization tends to eliminate these defects. Maintenance activities are organized on a functional line-and-staff basis (electrical maintenance, mechanical maintenance, etc.) and serve the *entire* plant rather than individual departments. Each functional unit is headed by an experienced, college-trained specialist in the unit's activities. He reports to the manager of maintenance, who is thoroughly experienced and trained in all phases of maintenance work. The manager of maintenance reports to the works manager at the same organization level as the plant operating managers, manager of steel plants, manager of fabricating, and other top executives.

This set-up provides an effective control of all plant maintenance activities because:

1. Maintenance work is authorized, planned, expedited, and coordinated by a *centralized* agency for all maintenance functions.

2. The purchase, storage, and disbursement of spares is centrally controlled through a *single* unit rather than by foremen and superintendents.

3. Maintenance employees gain a wide experience by working in different operating departments. They can be quickly and effectively moved to trouble spots.

4. Maintenance superintendents now work together. They meet weekly, sometimes oftener, with the manager of maintenance. They discuss and plan how and when their respective departments will share in the existing and projected work load. They iron out conflicts in the schedule, and establish job priorities and completion dates.

As a result, important jobs get done first; each department knows what the other departments are doing. Jobs move faster. There are fewer delays. And friction between departments has been largely eliminated.

We don't claim that all the bugs are out—yet. Only experience and continued effort will do that.

PLAN CHANGES CAREFULLY

How did we change from a decentralized to a centralized line-and-staff organization? If you're considering this step, don't think it can be done without careful preparation and planning. It can't.

You need to lay down some basic ground rules—principles—covering the type of organization you want. In addition, you'll require data and information dealing with every phase of the existing organization. These two guide posts helped us.

ORGANIZATION PRINCIPLES

1. Like or related functions will report to a single superintendent or supervisor.

2. Mixed functions, such as operating and maintenance, line and staff, will be separated wherever practicable.

3. Lines of authority and responsibility will be clearly defined, with duplication or overlapping eliminated. Each employee will report to, and be responsible to, only one supervisor.

4. The number of functions, departments, or employees assigned to a supervisor must be within his capacity to control their activities efficiently.

5. Individual duties and responsibilities will be explained to the individual employee.

6. Supervisors will be backed up by qualified assistants and staff specialists.

There are more organization principles, of course, but those listed above are the most important.

DATA NEEDED

1. Organization chart of existing organization. If none exists, have it made before making changes. You may think you know your organization without charting it. But, you may be surprised by what the chart will show.

2. Company policies. They may change your ideas about the approach, or you may want to recommend changes in policy. And as we already pointed out, don't overlook the policies that haven't been formalized in writing and exist by virtue of precedent, tradition, or practice. They may be more important than formalized policies.

3. Plant layout drawings. You can't really know whether functions can be consolidated, centralized, or related without a knowledge of the physical factors involved.

4. Personnel data. These consist of job descriptions, wage and salary scales, position classifications, personnel records, etc. Also, the union agreement, if you have a union. Such agreements have an important bearing on what can or can't be done.

HOW TO REORGANIZE

The maintenance organization in a large plant is a complex problem. To change it requires a high level of management skill plus a lot of practical knowledge about the plant, its methods of operation, special maintenance problems, key personnel, and future plans.

For these reasons our top operating management, industrial relations department, maintenance manager, and superintendents worked with consulting management engineers to develop the pattern. The final set-up is, however, the product of work done by the maintenance personnel.

Changing the organization structure is not—as

people sometimes think—just changing titles and rearranging blocks on an organization chart. There's lots more to it than that. In each instance you must consider the practical effect of the move on personnel, operation, and the organization as a whole.

Using our experience at Lukens as an illustration, here's the way we'd say to do it:

1. Classify principal maintenance functions. Using existing organization charts, sort out similar or related functions. Separate *obvious* line and staff activities. Design organization chart showing line, staff, and supervisory relationships. You will note in the chart on page 119 that our staff functions are classified in four groups: cost control, lubrication, facility projects, and inspection. Our line activities are grouped in five categories: engineering, mechanical maintenance, electrical maintenance, refractories and fuel, and machine and forge.

2. Analyze the functions performed by all shops and specialized departments, such as carpenter, smith and forge, general labor. Assign each shop or department to the maintenance function to which its work is most closely related or associated. As an example—

Department	Function
Drafting	Assign to plant engineering
Crane Service	Assign to electrical maintenance
Die Shop	Assign to machine and forge

The work of some departments will not always fit the desired pattern. In those cases we either made an arbitrary assignment or established a new department.

3. Centralize similar or associated functions. Analyze maintenance personnel and classify each one by function. List by name, position, actual work performed, and reassign to appropriate functional department.

Purpose: You create pools of qualified maintenance and repair crews that can be sent to any part of the plant at any time.

Another advantage: You increase the span of the employee's knowledge and experience, improve his opportunities for promotion. At this point you may have to change existing employee seniority subdivisions, or create new ones, to embrace the greatest coverage of work of the same type.

4. Separate, whenever practicable, mixed line and staff activities. As a general rule, the following functions, formerly performed by individual departments under the decentralized plan, are now considered staff work.

Reason: They are services generally performed for maintenance departments, as contrasted with line functions of repairing and maintaining the plant — a service to the operating departments. These staff functions are now performed by four newly created staff departments. Here are assignments of each new department:

Function	Staff Department
1. Lubrication	Lubrication
2. Inspection	Inspection
3. New facilities development	Facility Projects
4. Expediting	Cost Control
5. Work order preparation	Cost Control
6. Stenographic services & filing	Cost Control
7. Cost analysis, reports, charts, etc.	Cost Control
8. Estimating	Cost Control
9. Facilities inventory—records and control	Cost Control

The cost control department was newly organized to take over clerical functions formerly performed by superintendents, clerks, foremen, and others. We deliberately gave it some functions ordinarily handled by the cost accounting department. For example, the analysis of maintenance costs. We believe that data of this sort should be analyzed and processed at the point of use by people who understand and know how the data are to be used. You will see how the department operates when you read the section on work orders. Foremen and supervisors now have more time to supervise. Also, we were able to transfer eleven clerks from plant maintenance offices to more productive work.

5. Implement the plan. Organization plans on paper are worthless until they are enforced. Clear-cut policies and instructions must be given to each man when he is assigned to his job. You impair his usefulness if you don't answer these questions clearly for him and for those working above or below him:

(a) What are the boundaries of my responsibility and authority?
(b) To whom do I report?
(c) Who reports to me?
(d) What am I expected to do and what relationships am I required to maintain with other departments?

Our organization plan requires:

. . . a job description of each employee. A statement of his duties, responsibilities, to whom he reports, who reports to him, etc.

. . . an organization chart for each maintenance department showing functional and supervisory relationships. These are usually posted in the supervisor's office and are made available for reference. Also, a chart of the whole maintenance organization.

. . . published policies, procedures, and instructions in manual form (of company and maintenance division).

Turn the page

6. Tie in the maintenance organization with the accounting system. When you change the personnel make-up of a department, or its function, or create a new department, you affect costs. These changes must be geared to the accounting records if you want the right answers. We mesh the organization structure with our accounting records by using code numbers to identify each worker in all operating and maintenance departments, his rate of pay and type of work. This arrangement facilitates the quick accumulation, distribution, and analysis of cost by use of mechanical tabulating equipment. (The same principles can apply in plants not so equipped.)

7. Fit the right man to each job. An organization plan is no better than the relative abilities, knowledge, and concepts of the men assigned to each level of responsibility. Our problem—one common to all—was to find the right man for each job. The techniques we apply to the maintenance organization are not a part of the maintenance cost control program. They are, however, important tools for anyone who is trying to improve the performance in his department. Let's take a look at them:

(a) Intelligence, aptitude and related tests.
(b) Interviews and screening by top level managers and superintendents.
(c) Psychological tests—combination of interviews and appropriate tests by a qualified consulting psychologist.

The latter have proved to be most valuable. Employees with leadership potential have been "discovered" and placed in supervisory jobs. Others with undesirable personality traits, emotional problems, and habits that influence their work unfavorably are helped to overcome them. *The result:* better men and a more effective organization.

Set up adequate equipment records

If you don't control the physical facilities of your plant—buildings, equipment, services, inventories—you are leaving the door wide open to excessive costs. Here are some of the reasons:

1. Improperly designed or installed facilities will not efficiently perform the work for which they were intended. They lead to excessive downtime, lowered productive efficiency, and high maintenance costs. For these reasons, adequate safeguards must be set up so that every proposed facility purchase is approved both by the people who will operate it and the people responsible for maintenance.

2. Maintenance costs can't be effectively controlled unless the high-cost facilities can be pinpointed. Therefore, facilities must be identified so that the cost of maintaining each one can be determined.

3. Replacements and field changes affect current operating costs—also inventories of spare parts, engineering drawings, and so on. Unless they are regulated so that everyone concerned knows what has been done, excessive costs result from maintaining wrong spare parts in inventory, or from field changes not recorded on plant engineering prints.

4. The location of a facility usually determines the department or products to which depreciation and maintenance costs are charged. If the relocation of facilities is not controlled the costs are apt to be charged to the wrong department.

FACILITY INVENTORY • We maintain a perpetual inventory of our plant facilities. Don't confuse our records with the weak, ineffective equipment records you see in many plants. Usually they are not a vital part of any cost system. Nobody but the plant engineer uses them. They are not up-to-date, hence unreliable. They are not an accurate inventory of plant assets. Our records are tied in with the general ledger. We aim to make them the capital asset records of the company. Our inventory record tells us:

1. What kinds of facilities, how many of each, and location of each. It helps to pinpoint the sources of trouble, determine how many of each kind are

located in a single department or the entire plant.

2. The age, original cost, book value (if you want it), cost, and date of repairs, additions, alterations, and replacements. We can keep an eye on over-age, obsolescent, or high-cost items.

3. Machine capacities, engineering data, speeds, supplemental equipment, kinds of motors, etc. Our engineering, operating, and sales personnel make decisions based on this information. If it's on the inventory record they don't have to guess or make a special field inspection.

4. The inventory number of each machine—so that:

(a) All drawings, blueprints, bills of material, and engineering data can be indexed and cross-referenced with the inventory number.

(b) Work orders, maintenance orders, purchase orders, and all other expenditures can be "pegged" to a specific facility item.

(c) Repair, replacement, maintenance, and all other costs can be accumulated against the proper facility item.

You may wonder how it is possible to get so much information from an inventory record—and, if so, whether or not it pays its way. Our experience shows that it is not difficult to do—that it really pays off. The records are used by the engineering, estimating, cost control, and operating people so much, in fact, that they have become dog-eared after only a few months' use.

HOW TO SET UP RECORDS

We established our facility records through the use of conventional inventory procedures, an inventory number code, and adequate inventory forms. How we did it is important because of the complexity of some of our facilities and the end-results we were after. Here's a summary of our planned instructions, covering some 10,000 facility items:

1. Take physical inventory. List each item on separate numbered inventory cards. Use plant layout prints, divided into numbered areas to systematize work and insure complete coverage. Assign field engineers and inspectors to cover specific areas after training and instructions have been given to produce consistent recording of the information. List each facility on inventory card—zone number, location, department number, description, component parts, old number. Write inventory card number on machine with yellow chalk when inventoried.

Our facilities range from small drill presses with few component parts to large rolling mills with many hundreds. In all cases these are listed separately, either on the inventory cards or later from the blueprints. Pipe lines are identified as water, oil, etc., and further classified as lead lines, mains, etc. Systems of electric lines are classified by voltage—220, 440, 110, etc.—and whether inside or outside. Electric motors attached to machines or systems are generally listed with the facility, and described, showing make, horsepower, voltage.

2. Classify facilities. Sort inventory cards to type of facility such as open hearths, rolling mills, lathes, boring mills. List each item separately under its class on an inventory work sheet. This sheet shows description, department number, old number. You'll see later on why we do this.

3. Devise inventory number code. This code is the heart of the inventory control system. The pattern must provide plenty of room for expansion, be adaptable to tabulating methods, and offer a sure method of getting the right answers to cost and engineering questions. At this point we need the work sheets referred to in item 2 above. The number of items shown in the largest class of facilities sets the minimum limits for the number codes.

A six-digit code meets our requirements—ranging from 100,000 to 999,000. Here's the way it is broken down.

Facility Class Number	Component Part No.	Individual Facility No.
(999)	(9)	(99)

This principle is not consistently applied because identification requirements differ. Take furnaces, for example. A three-digit class number is assigned to each furnace; the last three digits identify component parts.

The 29 open-hearth furnace inventory numbers look like this:

301001	Complete unit
301(002)	Instrument and control unit
301(501)	D. C. motors on controls
301(601)	D. C. controls

The 112-in. rolling mill is set up this way:

201001	Complete unit
201002	Mill stand
201003	Shoe plates
201004	Screw down, etc.

4. Apply the inventory code numbers to the individual facility inventory cards. Send the cards to tabulating department where a master inventory tabulating card is key punched, verified, interpreted, and filed in facility number sequence for each item.

5. Reclassify maintenance expense-account codes to conform with the facility classification. This is necessary for two reasons.

Turn the page

(a) So that the proper accounting charges, department and account numbers will appear on each tabulating card. The cost control department enters the facility number, department number, and charge account on each work order. Maintenance employees don't have to "guess" or use their judgment to enter charge account codes on job cards and requisitions. All they have to do is refer to the work order to get the right numbers. This allocation of a definite charge-account number of each facility puts an end to excuses for "bad charges." It makes the cost statement more reflective of actual costs, hence more useful as a management tool.

(b) To answer management's big question better: "Where did we spend our maintenance money?" We use a maintenance account expense code in our chart of accounts. Numbers 301 to 399 are assigned to repair and maintenance labor—numbers 401 to 499 to repair and maintenance material. Here's an example:

	Account Numbers			
	Labor		Material	
Facility Class	Repairs	Maint.	Repairs	Maint.
Buildings	301	351	401	451
Machinery	302	352	402	452
Rolling Mills	303	353	403	453

With this acount arrangement, out-of-line costs stand out, stimulate questions, investigation, and action. Analysis will show what facilities, work orders, and functions caused the expenditure.

6. Prepare master inventory records. We organized our facility inventory records to give us all the physical facts, life history, and costs on each item. We started with the master inventory card. Then we made working copies and inventory lists, as needed, to make the information available to all maintenance and operating employees.

Let's look at these inventory tools:

(a) Master inventory card. A permanent record of each facility. Filed in facility number order in the accounting office. This is the heart of the system. It's an 8½x13-in. cardboard form printed on both sides. Besides the mass of information already told you—too much to reproduce in this article—it shows these four important items: (1) department location and number, (2) zone description and number, (3) facility class and facility number, and (4) charge-account numbers for department and expense. Our system could not work without them.

(b) Working inventory card. A duplicate of the master card, kept in the cost control department. It serves as a reference record of each facility for day-to-day operations of work-order estimating, cost control, plant engineering and production planning.

(c) Inventory list of facilities, arranged by department. Used by maintenance and operating employees to find facility numbers, charge account numbers. This inventory list was prepared by the tabulating department.

(d) Inventory list of facilities, arranged in facility class order. Used primarily by maintenance office employees to determine charge account numbers, location of facilities, how many available, and so on. Prepared by tabulating department.

(e) Tabulating card master. Preparation already explained in item 4 above on inventory code number. Used for special analysis of facilities, facility inventory reports, and the reproduction of inventory lists, items (c) and (d) above.

(f) Plant layouts. Floor plans of each zone in the plant, laid out to show the location and inventory number of each facility. Prepared by plant engineering department. Inspectors, maintenance crews, and operating personnel keep them at their work stations and refer to them constantly for information about the location, relationship, floor area and how occupied, inventory number of individual facilities. Their value is summed up by one operating executive who remarked, "I've been trying to get a reference source like this for twenty years—now I can find out where facilities are actually located."

7. Apply permanent facility numbers. Don't expect to maintain control of your facility inventory without proper physical identification. Make certain that:

(a) The facility number tag is clearly and permanently affixed to each facility.

(b) Facility number tags are not changed, defaced, or destroyed.

(c) The number is in exact agreement with the inventory record.

(d) An inventory number is assigned to each new facility when received at the plant, and that the tag is affixed when it is installed.

At Lukens the responsibility for assigning and affixing facility numbers is given to one individual in the cost control department. He keeps a log of each assignment (made at the time a new facility is ordered). He is responsible for the master inventory records.

Our tags are made from ⅝-in.-wide, 24-gage, zinc strip coils with a Roovers machine. This strip is then cut to 5-in. lengths and drilled, one hole in each end of tag. Tags are fastened with metal screws after holes are drilled and tapped. They are put on to stay for life.

To make certain that the right number tag goes on each machine, we supplied the riggers (who put them on) with a floor plan of each department, showing the location and number of each facility. A field engineer double-checks later on.

WEEKLY REPORT OF PLANT EQUIPMENT ACQUISITIONS AND CHANGES

REPORTING DEPT. Cost Control WEEK ENDING 3/15/52

FOR DEPARTMENTAL USE ONLY			FOR CHIEF ENGINEER AND COST CONTROL ONLY			
FACILITY NO.	EQUIPMENT DESCRIPTION	PHYSICAL DIMENSION OR CAPACITY CHANGES TO PRESENT EQUIPMENT	NEWLY ACQUIRED EQUIPMENT DESCRIPTION	W.O., P.O. OR REQ. NO.	AUTHORIZATION OR CHARGE	ASSIGNED FACILITY NO.
141001	Landis Roll Grinder, Roll Grind Shop	Increased swing from 44" to 60"	Truck unloading dock Corey Field	WO 26580	V-2441-16-10	010251
			Built by Lukens and E. A. Daylor	WO 26768	TM-3328-10	
			Assigned to Dept. #372	PO 14058		

REPORTING DEPARTMENT: By J. Montano OFFICE OF CHIEF ENGINEER: By N. Jensen

5

Keep equipment records up-to-date

Facilities are always being changed in our plant. New ones are being installed. Others are being replaced or moved to new locations. Old facilities are either scrapped outright or sold.

If our facility inventory records failed to show these changes as they occur, they would soon become worthless. Some of the reasons are:

1. When a new facility is acquired, the depreciation and maintenance costs are generally charged to the department in which it is located. For that reason, correct location is important to the accounting as well as the maintenance departments.

2. When facilities are moved from one department to another without notifying the maintenance and accounting departments, one department is charged too much, and another too little.

3. When facilities are retired, scrapped, or otherwise removed from service without proper recording, it also affects accounting and maintenance records. Here's what happens: Depreciation expenses for the facility continue to be charged to the department, thus overstating its expenses. Maintenance stores may purchase additional spare parts or retain parts in inventory that have no value.

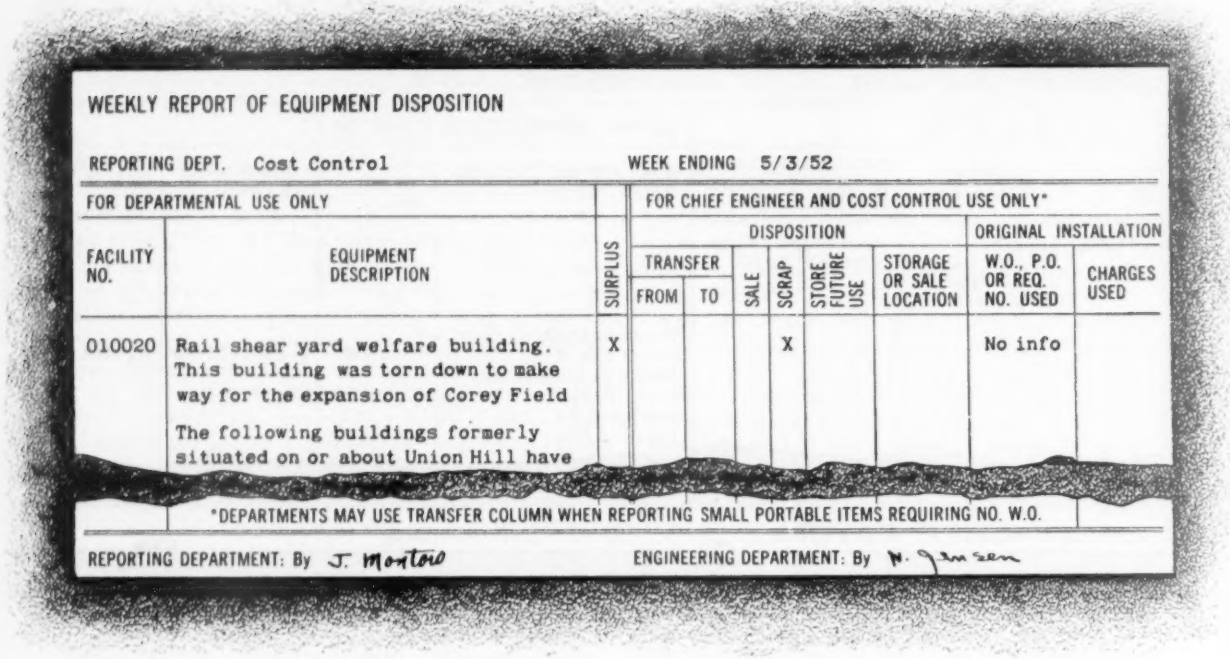
4. The dollar value of facilities owned by the company is overstated by the undepreciated value of the facility.

For these reasons, it is vitally important to control changes in facilities inventories. Our control procedure provides a double-check on new and replaced facilities, and changes in design. It features two weekly reports from each operating department to the cost control department, as follows:

1. ACQUISITIONS AND DESIGN CHANGES • Installation of new facilities or design changes to existing facilities are reported on a "Weekly Report of Plant Equipment Acquisitions and Changes." See above exhibit. It shows:

Facility inventory number—if in inventory
Description of equipment
Description of alteration—if in inventory
Description of facility—if new
Work-order number—if maintenance does work
Purchase order or requistion number if purchased
Appropriation or charge account number
Assigned facility number—if new

The facility engineer (senior estimator) in the



WEEKLY REPORT OF EQUIPMENT DISPOSITION

REPORTING DEPT. Cost Control — WEEK ENDING 5/3/52

FOR DEPARTMENTAL USE ONLY			FOR CHIEF ENGINEER AND COST CONTROL USE ONLY*							
			DISPOSITION						ORIGINAL INSTALLATION	
FACILITY NO.	EQUIPMENT DESCRIPTION	SURPLUS	TRANSFER FROM	TRANSFER TO	SALE	SCRAP	STORE FUTURE USE	STORAGE OR SALE LOCATION	W.O., P.O. OR REQ. NO. USED	CHARGES USED
010020	Rail shear yard welfare building. This building was torn down to make way for the expansion of Corey Field The following buildings formerly situated on or about Union Hill have	X				X			No info	

*DEPARTMENTS MAY USE TRANSFER COLUMN WHEN REPORTING SMALL PORTABLE ITEMS REQUIRING NO. W.O.

REPORTING DEPARTMENT: By J. Montoia — ENGINEERING DEPARTMENT: By N. Jensen

cost control department checks information on this report with work orders, final proposals, and purchase orders. After verification he posts the additions and deletions to the facility inventory record. He then sends the report to the tabulating department to make the necessary changes in its own master inventory files.

A copy of the same report is sent to the accounting department, where the information is checked with the capital assets accounts. Discrepancies are corrected as they occur, thus insuring more accurate inventory and capital assets records.

2. TRANSFERRED OR SCRAPPED EQUIPMENT • Relocated or retired facilities are controlled through a "Weekly Report of Plant Equipment Disposition." See exhibit above. It shows:

Facility number
Description of facility
Whether the facility is a surplus item—not needed
Transfer information—relocated from—to department
Disposition—sale, scrap, store for future use
Storage location
Original installation source information, work-order number, purchase order number, requisition number, and account charges

Weekly reports are required to emphasize the importance of the information and prevent failure to report. If there are no changes, they report "none." The facilities engineer checks for receipt of each department list. All lists must be accounted for—no chance for a slip-up.

The facilities engineer checks the information on the report with facility inventory records, and:

1. Removes master and working facility inventory cards from files—posts date scrapped and any other pertinent information to cards. Files cards in facility "dead" file.
2. Corrects the charge department numbers of relocated facilities on the inventory records and on the accounting copy of the weekly report.
3. Posts information on inventory "Additions and Deletions" record. Sends one copy to tabulating department to remove master inventory cards from files.
4. Sends copy of weekly report to the accounting department for it to delete the scrapped facilities from the capital assets and depreciation accounts. Surplus facilities earmarked for sale are stored at the direction of, and under the control of, the works accountant. Sale or other disposition is accomplished through the purchasing department. Final recording of disposition is done in the same way as for scrapped facilities. Relocated facilities are checked to the capital assets records and the department depreciation charges are adjusted to reflect the relocation.
5. Maintenance stores is told to check spare parts and dispose of unusable items.
6. Plant engineering department is notified of facilities disposed of so it can remove drawings and engineering data from current files.

6

Regulate purchase of new facilities

"What's the control over purchase of plant facilities got to do with maintenance cost?" you may ask. Our answer:

That's the place you start to control maintenance costs.

If proper attention is not given to design, construction, and capacity as related to your specific needs, and to the cost of maintenance and replacement, you may spend many times the original cost of the facility by reason of inefficient operation or high maintenance expenditure.

Our approach is systematically to investigate each proposal to determine that:

1. We actually need the proposed facility.
2. It will do the job for which it is intended.
3. The projected operating and maintenance costs will offset the original cost in a reasonable number of years.
4. The type, design, or other characteristics will not create excessive maintenance costs or require excess inventories of repair parts, materials, or tools.
5. The facility fits into our established pattern of facility standardization.

You may think that this approach takes too much time or that it is bound up in red tape. (As for red tape, some people always complain when orderly procedures keep them from making snap judgments or taking action before all the facts are known.) This approach does take more time than our former method. But we now have answers that weren't available before, and we don't make the same mistakes. Group judgment has been substituted for individual opinion. Decisions to purchase or not to purchase are based on factual data. Purchases are made with eyes wide open to the effects on maintenance, production, and personnel.

HOW TO CONTROL PURCHASES

We use two forms:

a. "Tentative Proposal for Capital Addition, Replacement, or Repair."

b. "Final Proposal for Capital Addition, Replacement, or Repair" (exactly same format as "Tentative Proposal," but white instead of pink).

These forms are used to request the purchase of plant facilities exceeding $500, and to make all major repairs and replacements. Under our procedure, appropriations cannot be made to cover the purchase or building of a facility until the final proposal has been approved by the management. This procedure prevents unauthorized purchases. In addition, it facilitates the maintenance of the capital assets records.

TENTATIVE PROPOSAL • This proposal is what the name implies—a suggestion based on preliminary studies and tentative estimates. It permits everyone concerned to consider the proposal from the viewpoint of economic value without going to the expense of making detailed engineering drawings or industrial surveys.

We use this form mostly when the proposal involves complex manufacturing, construction, maintenance, or engineering problems. It would not be used to purchase a small drill press, for example, where the facts are generally known and accepted. A final proposal would be used in that situation.

TENTATIVE PROPOSAL PROCEDURE • All requests for new facilities are submitted to the manager of maintenance in writing, showing the reasons why needed, expected benefits, location, etc. He refers this information to the plant engineering department to make a preliminary investigation, make rough drawings, and prepare tentative specifications and bills of material.

These data are then given to the industrial engineering department for study and investigation to determine potential savings and benefits, effect on productive capacity and existing facilities, wage incentive plans, union agreements, and employee relations. The results of these investigations are submitted in writing to the cost control department accompanied by a request for the facility and engineering data.

The cost control department prepares cost estimates from the engineering data and prepares a tentative proposal (3 copies). Two copies are forwarded to the manager of maintenance, and one copy is filed for follow up.

The manager of maintenance reviews the tentative proposal with the superintendent and staff specialists to determine that the proposed facility will (1) meet engineering and maintenance design requirements; (2) won't cause excessive maintenance cost; (3) will do the job for which intended; and (4) will project enough savings to pay for the investment within a reasonable period of time.

If rejected at this point, the proposal is returned

FINAL PROPOSAL FOR
CAPITAL ADDITION, REPLACEMENT, OR REPAIR

ESTIMATE No.	2539
WORK ORDER No.	38548
"V" OR "TM" No.	V-2514

DATE 10-13-52 DEPARTMENT Engineering

SUBJECT Air Compressor-General Plant Supply PROPOSED BY N. H. Jensen

PURPOSE OF PROPOSED EXPENDITURES: (Capital addition) (Replacement) (Repair)

Due to compressed air shortage, it is necessary to install a new compressor to supplement the present compressed air supply. Machine will be installed to deliver directly into the present compressed air distribution system.

To be located in central pumping station. See attached data sheet.

DESCRIPTION OF PROPOSED EXPENDITURE: (Describe work to be done or purchased)

Purchase and installation of:

(1) Worthington, Type DYC-2, size 17¾/17¾/16x9½, heavy-duty, vertical-angle, double-acting, 3-cylinder, 2-stage, water-cooled, feather-valve air compressor. Discharge capacity 2086 cu.ft./min. at 450 RPM, drive 400 HP, 2300-V motor.

APPROVED:
MGT. COMM. 12/31/51

ESTIMATED COST: (Show elements of labor, purchased material, overhead, engineering, etc.)

1.	Compressor complete with motor and variable capacity control with standard equipment		$33,350
	Freight		1,000
2.	Foundations		1,900
3.	Mech. Installation incl. O.H.		2,250
4.	Electrical Installation:		
	Material	$5,800	
	Labor incl. O.H.	1,400	7,200
5.	Engineering		1,000
	*Total Estimated Cost		$46,700

ESTIMATED SAVINGS: (Show anticipated annual reduction in cost and reasons)

*Note: Of this total, $4,200 is included to cover increased labor costs and probable price increase due to effect of steel industry wage settlement. $6,800 covers increase over Tentative Proposal for material and labor not included in original proposition.

CHARGE TO: CAPITAL ACCOUNT V (x) TM EXPENSE ( )	REVIEWED BY	CHIEF ENGINEER N. H. Jensen	10/4/52
CHARGE ACCOUNT No. 511-2514	MECHANICAL MAINTENANCE R. G. Uhler	APPROVED: MGR., CONSTR., and MAINT. Harry A. Fohl	10/4/52
REASON FOR REJECTION	ELECTRICAL MAINTENANCE M. B. Antrim	GENERAL WORKS MANAGER L. M. Curtiss	10/6/52
	MACHINE and FORGE E. A. Berry	CONTROLLER R. G. Bloom	10/8/52
	FUEL R. R. Fayles	VICE PRESIDENT, OPERATIONS G. D. Spackman	10/9/52
	ENGINEERING	PRESIDENT C. L. Huston Jr. FOR BOARD OF DIRECTORS	10/10/52

to the person making the request with a statement of the reasons for rejection.

If approved, each superintendent signs the tentative proposal, and it goes to the management committee. The committee reviews the proposal from the viewpoint of over-all company requirements, potential savings, useful economic life, and effect on operating capacity and costs. If the proposal has merit, it is approved and returned to the manager of maintenance for preparation of a final proposal.

There are many advantages to this approach. For instance:

1. The "bugs" in the proposal, if any, are usually caught before a lot of time and money has been spent.
2. Potential savings and benefits are fairly evaluated so that the economic worth of the facility can be more accurately projected.
3. Management does not need to spend much time investigating a proposal.

FINAL PROPOSAL PROCEDURE • The tentative proposal, when approved, is sent to the cost control department. Work orders are issued, authorizing the plant engineering department to complete final drawings and specifications. Then final estimates are prepared.

If further investigation by the industrial engineering department is required, it completes its survey and investigation, discusses findings with cost control department, and prepares a written report.

Cost control then assembles these final data and prepares the final proposal (three copies). This form is then processed for approval in the same manner as the tentative proposal. In addition, it goes to the controller's division to show the correct accounting numbers, whether the facility is a capital item, replacement or repair, and the appropriation number.

Final approval and appropriation of money to cover the proposal rest with the president or the board of directors, depending on the amount of money required.

The approved final proposal (see facing page) is returned to the cost control department, which issues the necessary work orders and purchase order requisitions to start the project.

ESTIMATED COSTS CHECKED • Control over the cost of a facility doesn't stop with approval of a project. Progress reports are necessary. We issue them on all major construction and repair jobs as needed. Weekly tabulated reports showing hours worked and accumulated costs are also made available to management.

At the end of each four-week period, estimated and actual costs of each part of the program are accumulated and compared. A report is then prepared for management, showing estimated and actual costs to date for each approved final proposal. It also shows the unexpended or overexpended appropriation balance.

Whenever the costs exceed 5% of the amount appropriated, a detailed explanation showing the reasons must be prepared for management by the cost control department.

When a project is completed, the costs are transferred to the capital assets ledger kept in the general accounting department. The detailed cost information is filed with the final proposal to provide a permanent source of information in the cost control department.

Get the cost of every job

The extent to which you can control maintenance costs depends largely on the degree to which they can be measured and analyzed. Comparison of actual costs with normal operating costs or predetermined performance standards localizes undesirable conditions. You then analyze specific areas of unfavorable variation and correct them.

We found that departmental breakdowns won't do—they don't go far enough. Maintenance operations, generally, are too complex to be susceptible to analysis on such a broad basis. We had to develop a more precise and meaningful method of control.

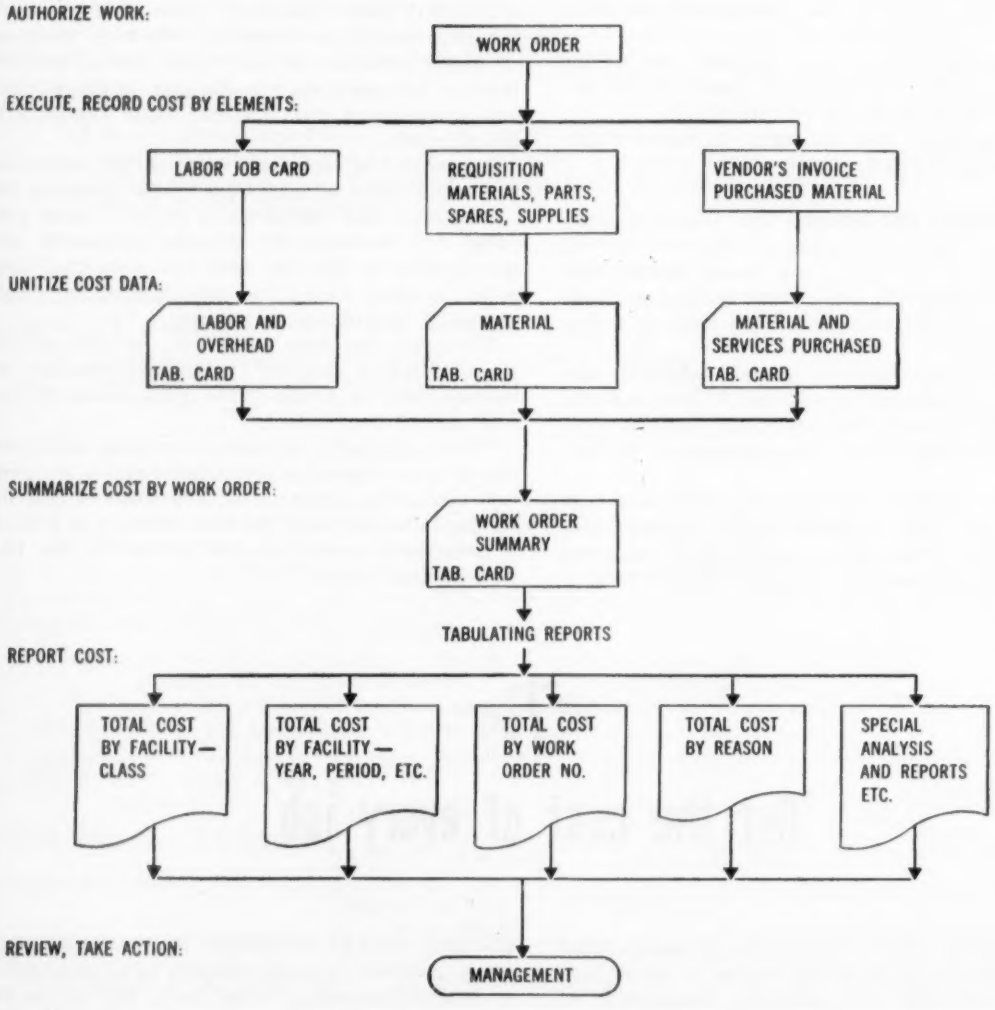
Job-order costing procedures provided this basis, because with these procedures costs are related to specific and identifiable jobs. *Turn the page*

CLERICAL PROCEDURES MANUAL

ORIGINAL ISSUED 7-22-49 REVISION NO. ISSUED 7-22-49 SECTION Cent. Maintenance

FLOW CHART – BASIC PRINCIPLES JOB ORDER COSTING
CENTRALIZED MAINTENANCE DEPARTMENTS

PRINCIPLE: Authorize work– accumulate all elements of cost by Work Order Number and Expense Account Number, prepare tabulating cards for each item of cost; summarize by Charge Account Number for expense account distribution, summarize by Work Order Number to determine cost by Work Order Number. Prepare reports for appropriate management action.


AUTHORIZE WORK:
WORK ORDER
EXECUTE, RECORD COST BY ELEMENTS:
LABOR JOB CARD
REQUISITION MATERIALS, PARTS, SPARES, SUPPLIES
VENDOR'S INVOICE PURCHASED MATERIAL
UNITIZE COST DATA:
LABOR AND OVERHEAD TAB. CARD
MATERIAL TAB. CARD
MATERIAL AND SERVICES PURCHASED TAB. CARD
SUMMARIZE COST BY WORK ORDER:
WORK ORDER SUMMARY TAB. CARD
TABULATING REPORTS
REPORT COST:
TOTAL COST BY FACILITY— CLASS
TOTAL COST BY FACILITY— YEAR, PERIOD, ETC.
TOTAL COST BY WORK ORDER NO.
TOTAL COST BY REASON
SPECIAL ANALYSIS AND REPORTS ETC.
REVIEW, TAKE ACTION:
MANAGEMENT

In addition, our job-order costing procedures give the detailed information from which we can pinpoint out-of-line costs and unfavorable conditions in other phases of maintenance operations. For example:

1. High-cost facilities. We can determine the frequency, kind of repair, and cost for each facility by associating each job order with the facility number, and by accumulating, comparing, analyzing, and evaluating the costs.

2. High-cost maintenance functions. We accumulate the cost of each function on a blanket order. Comparisons of costs from week to week disclose variations from normal and highlight the undesirable conditions. Blanket orders have dollar or man-hour limits so they won't become a burying ground for unauthorized costs.

JOB PLANNING

More important, however, than the foregoing benefits is the fact that our job-costing procedures promote sound planning of maintenance operations. We have proved that the ultimate cost of a job depends, to a great extent, on how thoroughly and efficiently it is planned. Our planning involves:

1. A precise description of each operation and the sequence in which it is to be performed.
2. The listing of specifications, tolerances, drawing and part numbers, quantities and types of material.
3. The assignment of each operation to a specific craft section—the one that will perform the work most efficiently and economically in accordance with schedule requirements.
4. A description of the machines to be used, tools and tool numbers, or any special equipment.
5. Estimating, wherever practicable, the time required for each operation.
6. A scheduled "start" and "finish" date for each operation.

You can see that planning procedures like these establish the basis for performance standards and cost comparison. They lead to the effective utilization of men, machines, and material. Work planning is another tool with which to control costs.

JOB-ORDER PROCEDURES

Should the maintenance department set up its own cost system independent of the accounting department? We say *no.*

An important element in our maintenance cost system was the decision to use our normal cost accounting procedures to produce cost data. We use our tabulating equipment to accumulate work-order costs and to control work orders in process. Thus we simplified our costing operations and minimized clerical costs.

Four forms are used at Lukens to regulate job-order costing. They are: (1) service request, (2) work order, (3) emergency work order, (4) work-order master tabulating card.

Before dealing with the procedural details, we need to look at the principles that keep the system working. The important ones are:

1. All work must be authorized by a work order—no work is done without one, either regular or emergency.
2. Work orders will not be issued until a properly prepared service request or an emergency work-order request has been received and approved by the cost control department.
3. Emergency orders will be used only when facility breakdowns must be repaired immediately to prevent delays in productive operations.
4. Maintenance functions consisting of highly repetitive or short-cycle operations will be authorized by a blanket work order. The regular work-order form is used, but is issued for the period of one year instead of for each job.

SERVICE REQUEST • The service request form is prepared by the operating or maintenance supervisor in triplicate. The original is sent to cost control, the duplicate to the production division manager, and the triplicate is filed in the production department for follow-up.

You may say, "Why not use the telephone to request a work order? It would be cheaper and faster." The answer is not that simple. Experience has shown that operating and maintenance personnel many times request work that:

. . . shouldn't be done at all because it's unnecessary, improper, or has already been requested.

. . . should be done at some other time because the proposed work relates to a larger job being planned elsewhere.

. . . should be requested by someone else because it comes under other authority.

A written request tends to screen out the unimportant or unnecessary, because after requests of this type have been turned down a few times, people stop preparing them.

A written request establishes responsibility, prevents mistakes or misunderstanding about what is to be done, and provides the data necessary to accumulate costs. Some of these are:

a. Facility number, secured from facility inventory tag.

b. Reason for repair, taken from our reason code list. This code permits the accumulation of costs showing how much was caused by improper lubrication, using machines for purposes not intended,

and so on. It spotlights the causes of avoidable maintenance costs, fast.

c. Department charge, so that costs will be charged to the proper department.

The division manager personally reviews all service requests to determine whether they meet the needs and objectives of his division. Rejected ones are returned to the requestor. Approved ones are sent to cost control. This is a second control step. Many proposed jobs are rejected at this point.

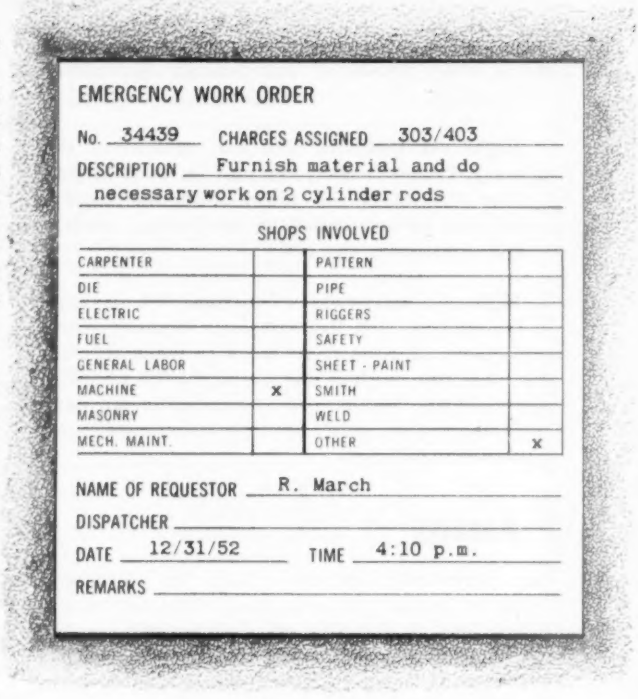
The cost control department matches the approved duplicate service request with the original and destroys the duplicate copy. It then examines the original to see that:

1. The form is completely and properly prepared, and that no pertinent information is lacking to plan the work.

2. There are no special problems involved that will require investigation, field trips, conferences with management or others. If special problems do exist, it takes appropriate action to solve them.

3. The request does not cover the purchase or building of capital assets. If so, the procedure outlined under the tentative proposal for capital expenditures must be followed.

This is a third control point. Many requests are rejected or sent back for revision at this step. Unnecessary or improper jobs are stopped before the money is spent. In case you think this routing is cumbersome, as a rule we translate a service request into a work order within 24 hours from issue.



EMERGENCY WORK ORDER

No. 34439 CHARGES ASSIGNED 303/403

DESCRIPTION Furnish material and do necessary work on 2 cylinder rods

SHOPS INVOLVED

CARPENTER		PATTERN	
DIE		PIPE	
ELECTRIC		RIGGERS	
FUEL		SAFETY	
GENERAL LABOR		SHEET - PAINT	
MACHINE	x	SMITH	
MASONRY		WELD	
MECH. MAINT.		OTHER	x

NAME OF REQUESTOR R. March

DISPATCHER

DATE 12/31/52 TIME 4:10 p.m.

REMARKS

WORK ORDER • The service request now goes to the estimators. We have three, one for each type of work—electrical, mechanical, and construction. The estimators plan the operations to be performed and prepare a work-order worksheet in pencil. On simple jobs a typist prepares the work order directly from the service request without the worksheet.

The estimator proceeds as follows:

1. Secures drawings, specifications, bills of material from the plant engineering department.

2. Determines requirements for parts, material, and suggests supplier and source. Authorizes issue of necessary purchase order requisitions.

3. Plans maintenance department operations in sequence showing:

a. Departments assigned to perform operations.

b. Materials, parts and part numbers, specifications, tolerances, etc.

c. Drawing numbers, tool numbers, machine numbers, etc.

d. Scheduled "in" and "out" dates.

e. Estimated machine and man-hours.

At the present time we schedule all work done by the machine shop and establish time allowances based on time studies made by our industrial engineering department. We haven't yet reached the point of scheduling and establishing machine and man-hour performance standards for other departments because we don't have sufficient engineering and experience data. This phase of work measurement is part of our long-range cost control program.

4. Enters control information, such as work-order number, date issued, charge department number, charge account number, facility number, reason code number, scheduled completion date.

This information is the key to our cost and accounting control. Comparisons between actual cost and normal cost or performance standards would be valueless if actual cost data were inaccurate. All material, labor, or other costs incurred in connection with the job are charged to the work-order number, charge department, and expense account numbers taken from the work order.

5. Types work-order Heckto masters (prenumbered), reproduces and issues as follows:

a. Shops doing the work.

b. Cost control files.

c. Tabulating department.

6. Posts work-order number and departments doing work to work-order control log. This is a reference list to help expediting, and keep track of orders.

7. Files work-order copy with master copy and working papers in work order sequence.

Because we use the mechanical tabulating equipment, the tabulating department prepares a master description card (alphabetic) for each work order issued. This card is used to control orders in process and as a description card for work order cost reports or detailed analyses. It is filed in work-order-number sequence.

EMERGENCY WORK ORDER • Our system has a fundamental principle that paperwork must speed repairs and never be permitted to delay them. To prevent delays in following normal work-order procedures, emergency repairs are treated the same as normal orders except as follows:

a. A series of work-order numbers is assigned to the departments where breakdowns of an emergency nature occur.

b. The maintenance supervisor assigns a work-order number to each emergency job, instructs everyone working on the job to charge time and material to that number.

c. He then prepares an emergency work order, showing the work-order number assigned, accounting charge account number, description of work and shops involved.

d. This is sent to cost control with the service request. It then prepares a work order without screening, planning, or estimating the job.

WORK-ORDER COSTS

The foundation for accumulating accurate maintenance costs has now been laid. All work carries an order that tells by its code numbers where done, why done, and how it is to be charged.

The code numbers—charge department number, charge account numbers—are entered by workers on all records of original entry, such as job time cards, store requisitions, and purchase orders. The cost items flow as shown in the chart on page 130.

In our case the tabulating department punches tabulating cards for each item of expense, sorts them by work-order number and reproduces a duplicate deck of cards which is filed in a "Maintenance Work in Process" file. The original deck of cards is sorted by charge department number and expense account number. A summary of charges to these classifications is made for the cost accounting department at the end of each month.

8

Keep tabs on maintenance parts

Maintenance spare parts, spares, and other material account for a large share of maintenance expenditures in many companies. Control over them is a serious problem because of the great variety needed. Turnover may be low, yet you must keep enough on hand to make immediate repairs.

In situations like this there's a tendency to order more parts than are needed, and to cache them around the plant. Then, when you forget about parts made obsolete by changes in design of facilities, it adds to the problem.

How can workable controls be established and maintained? We haven't answered the question to our complete satisfaction, but this has been our approach:

1. Centralize control of all maintenance material functions, such as ordering, receiving, storing, and disbursing.

2. Consolidate storage locations, and provide "locked door" protection of expendable, perishable, or high-cost items.

3. Establish an adequate system of paperwork and procedures, such as (a) inventory cards, (b) bin identification, (c) adequate drawings and engineering data, (d) inventory usage and turnover reports, (e) perpetual physical inventory verification, (f) maximum and minimum quantity standards for each inventory item.

4. Start standardization program to reduce inventory to a more economic level.

We are making substantial progress with this program. Maintenance material orders are now processed through cost control (to check specifications) before they go to central stores. Orders are not approved until central stores checks stock balances and shows a definite need. We've cut down storerooms to one-fourth the old number.

Tools are controlled through tool cribs. New

tools are not replaced with the employee unless he returns the tools he is charged with. Important savings have been made through this practice. In addition, a tool salvage program has made it possible to cut expenditures for new tools. This has made individual employees conscious of the importance of using tools properly. We have cut repair and maintenance parts for small tools in half. This item alone saved us about $50,000.

Tabulating reports are prepared each month showing usage, by departments, of expendable stores such as hammers, tapes, shovels, sandpaper. Other reports show the total stock on hand. These reports are discussed periodically at superintendents' meetings. As a result, a decrease in usage of nearly 40%—a saving of nearly $3000 a month on maintenance parts alone—was made in a single division.

Devise and study executive cost reports

The big pay-off in setting up our maintenance cost system has been in the wise provision and interpretation of summary and executive reports to control maintenance activities. When our people know the facts, they can act.

Our reports are basically of two types—progress reports and completed order reports.

PROGRESS REPORTS

1. Weekly tabulation of work orders, showing amount spent for labor, material, and burden, and the cumulative total to date.
2. Special reports on individual jobs, showing cost to date and analyses of each class of cost—labor, material, and burden.
3. Weekly labor distribution for each maintenance division showing hours and cost for regular repair orders, emergency orders, blanket orders, non-productive labor.

COMPLETED ORDER REPORTS

1. Cost of completed orders, showing total hours, labor cost by department, material, and other costs.
2. Analyses of completed-order costs, showing detail of expenditures, labor, and material.
3. Blanket order costs for period, and costs to date.
4. Costs itemized by reason code, showing how much was spent because of improper maintenance, inadequate lubrication, and so on.

These reports provide a basis for comparing costs with previous reports or measuring them against estimated hours and costs. Out-of-line costs stand out and lead to corrective action.

FUTURE PLANS

Early in this article we mentioned the long-range objectives of our program—labor standards, budgetary control, and planning and scheduling of significant field work (as well as shop work) by the cost control department.

None of these steps could be considered without the careful foundation already laid. Present plans call for a budget based on a planned and estimated schedule of repairs and maintenance for each department. This will be tied in with the accounting records so that comparison between budget and actual figures can be made each month.

We recognize that conventional budgetary control methods can be an inhibiting influence on sound maintenance practices. Supervisors tend to pass up needed repairs to make their budget look good. Then operating and product costs increase because of inadequately maintained facilities.

We plan to avoid the type of budget that will lead to these mistakes. How? By basing the budget on a realistic appraisal of plant needs for normal repair and maintenance costs. Our cost system will supply these data with reasonable accuracy. We'll take care of unforeseen costs by a separate cushion. We'll know what our plant maintenance should cost, and check all variances for an explanation as to why it didn't meet those figures. Any attempt to do this without the basic program of controls we have built to date would be putting the cart before the horse.

This "kitchen-in-the-corner" feeds
1000 workers daily in 35 minutes, serves...

Fine Food at Low Price—and a Profit

No room for a cafeteria at Moloney Electric. The kitchen is in a corner of a warehouse. Food is served right in the plant from mobile trucks.

Total capital investment is small. Yet 1000 workers get fine food at low cost—in one short lunch period. And—to top it off—the set-up's paying for itself!

CAN'T BE DONE. That's what management executives at Moloney Electric Company's transformer plant in St. Louis thought—until they did it.

In terms of results, Moloney's new food service plan is actually showing enough net income to more than amortize the investment in equipment that was required, and also to return a fair profit.

But, in addition, the food service installation has been made with little loss of valuable plant floor space, and at a remarkably small cost.

The Moloney people found a corner of the warehouse, 25x40 feet, that could be spared by some rearranging of storage facilities. In this area they installed a complete little kitchen where all food is cooked and packaged in sanitary disposable containers. They even had room left over for a 10x11-ft. loading area for mobile food trucks.

They use four modern, electrically heated self-service food trucks to distribute the food in the plant. Each truck has its own fixed station, and serves food only during the plant's single 35-min. lunch period. Cruising food trucks did not work out satisfactorily.

The trucks were designed by engineers from Factory Stores, the industrial caterer responsible for the installation. They were made from stainless steel right in Moloney's own maintenance shops. Plug-in electrical connections keep hot foods at the right temperatures.

The total capital investment, including building changes for the kitchen, restaurant equipment and mobile trucks was less than $15,000. Compared with the cost of most plant kitchens and cafeterias, this is an unusually low figure.

CURVED TRACKS follow auto body contours, guide guns in Nash automatic spray booth. Floor conveyor pulls bodies through backward at the rate of 14 feet per minute. Three paint guns—one for each side, one for the top—make one pass for each 4-in. advance of the body—42 passes per minute. Changing colors takes only the time that would be needed for one body to pass.

For auto bodies—or whatever your product, you get a...

Better Paint Job by Automatic Spray

ADD NASH MOTORS to the growing list of boosters for automatic spray painting. Gives you a better paint job than you get with hand spraying. Better because you're sure of uniform paint coverage and closer control of film thickness.

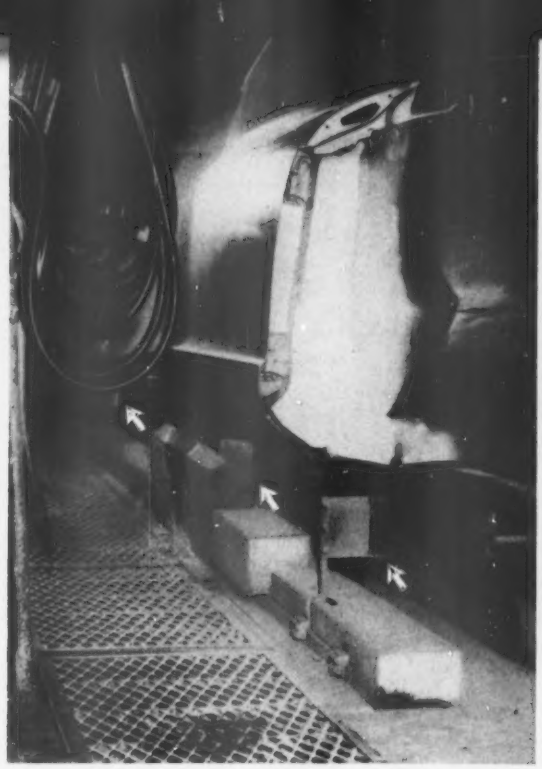
Nash uses automatic spraying in both its Kenosha and Milwaukee plants. The booths in Kenosha were specifically engineered for automatic spraying; in Milwaukee they were adapted from hand spraying. In both places, says Nash, benefits are material. For instance:

- **Paint foremen check paint thickness only once a day—once is enough.** "Too little paint" has been virtually eliminated as a cause of rejects. "Sags," caused by too much paint, have been "sharply reduced" on Milwaukee's prime coat line, are "very low" on Kenosha's body line, have been "cut down 30%" on Kenosha's fender line.
- **Less paint is used to do the same job, because there's less overspray.**
- **If desired, a heavier coat can be applied than with hand spraying**—the equivalent of two hand-sprayed coats at one pass, automatically.
- **Maintenance is cut, too.** In Milwaukee, two booths handle the work that formerly took four. That means half as much booth maintenance—and half as much floor space.
- **And labor costs are down.** At Kenosha, on the body line (picture above), six men can handle the shift schedule—two coats. One changes colors when necessary, the others hand-spray surfaces the automatic guns can't reach—the rear of station wagons, windshield supports, the spare tire cover inside the trunk.

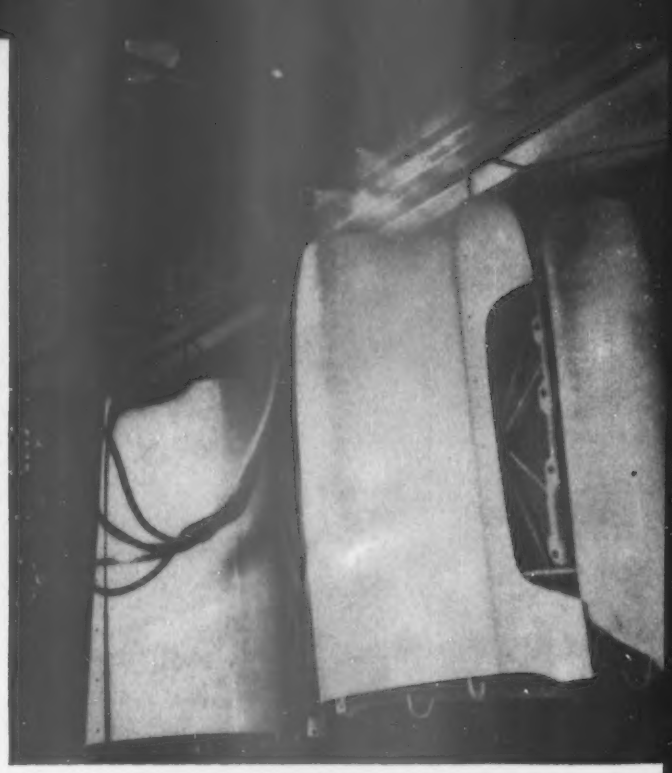
On the fender line (top right on the opposite page) four men are needed per shift. Two are operators (changing colors, adjusting air pressure, cleaning guns), one is a maintenance man (with other duties as well), and the fourth touches up any spots missed by the automatic guns.

With the promise of such benefits as these, you might well investigate automatic spray painting for your own product, no matter what it is.

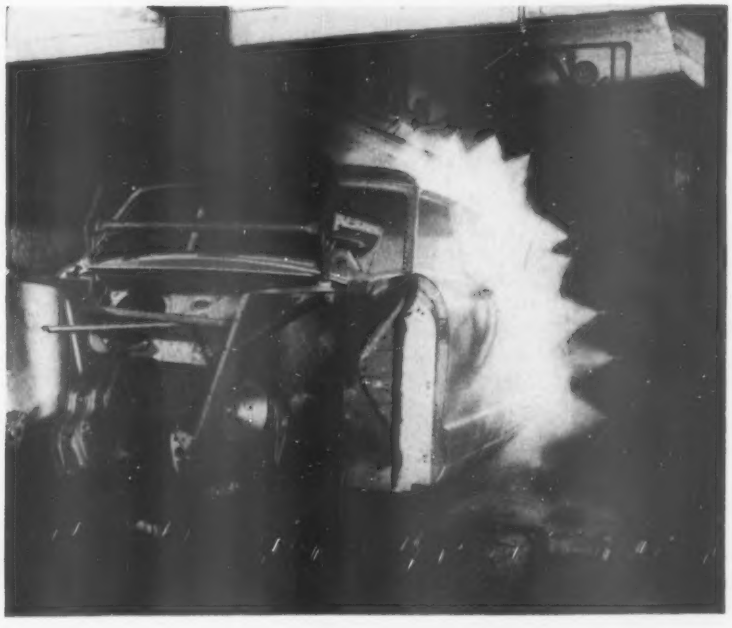
The pictures on these two pages give more details about the automatic spray-painting installations. The three pictures across the top show installations at Kenosha. The fourth picture was taken in Milwaukee.



FLAG LEVERS (see arrows) that control paint guns are actuated by triggers on conveyor trucks that carry bodies. Flag 1 (tripped by all models) starts side guns. Flag 2 is in two sections—bottom section only (for station wagons) turns on top gun to paint roof; entire flag (trunk models) turns on top gun and lowers it to paint trunk top. Flag 3 (trunk models) raises top gun again to paint roof. Flag 4 (all models) brings top gun down to paint cowl and inside of engine compartment, turns off side guns. Flag 5 (all models) turns off top spray gun, raises it to its original position. Then next body comes through and cycle repeats.



ONE PASS OF GUN sprays first color coat on three fenders. Parts, mounted three to a holder, are pulled through booth on conveyor, rotating as they go. Guns are mounted on movable tower, travel with parts—6 feet for one pass. Tower then returns to starting point. Parts go on to second tower for finish coat, 30 seconds later. Each tower holds two guns, one fixed and one movable. Movable gun, controlled by cam arrangement, follows contour of parts, moving up with one group, down with the next. Stationary gun cuts in only at top of pass. Limit switches automatically control movement of towers and guns.



EVERY 52 SECONDS a body gets its prime coat automatically sprayed on in this booth in the Nash Milwaukee plant. Overhead conveyor to carry bodies made fixed guns necessary. Nash found advantages of automatic spraying justified trouble and expense of adapting this booth. One automatically sprayed coat is the equivalent of two hand-sprayed coats. Paint guns are triggered by switch on body truck, spray only when car is passing through booth.

1 **STARTING HIS DRIVING TEST.** Monsanto operator coasts fork truck into pallet and picks up load. He must enter pallet in one swing without bumping load.

2 **EXAMINING COMMITTEE** watches driver try to set loaded pallet against

Fork Truck Operators Help

This fork truck operator training program isn't theoretical. It's practical from start to finish—from operators' participation to big improvements in materials handling operations.

IT PAYS TO TRAIN FORK TRUCK OPERATORS. We think so anyway—and with good reason. Our training program has:

- Trimmed truck maintenance costs by 39%.
- Almost wiped out truck accidents.
- Nearly eliminated materials damage caused by faulty handling of trucks.

WHY WE TRAINED • Our fork truck problems probably were no worse than those of many other companies. But they had reached a point where we couldn't afford to ignore them.

Truck maintenance costs were soaring. So was the number of "near-miss" accidents. Careless or unskilled operators were damaging more and more packages, causing more and more losses of materials. Something had to be done.

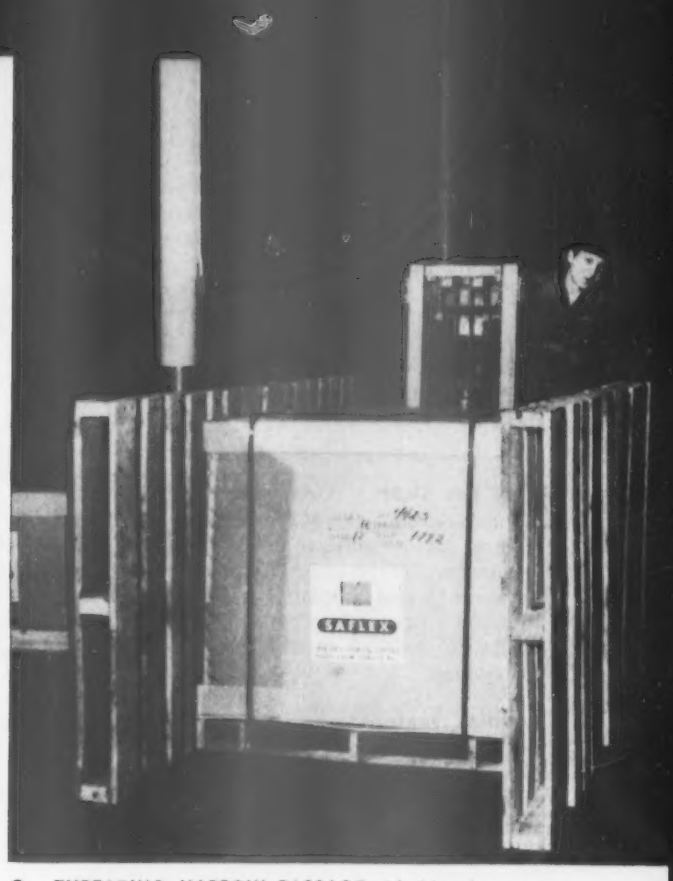
Our Training Plan for Old Drivers

Our first aim was to retrain the men who were already driving our trucks. To start the ball rolling, we set up a committee composed of one representative each from the maintenance, safety, production, and transportation and materials departments. The committee worked up the following three-part training program:

1. IN THE CLASSROOM • Each operator attended two 1-hour class sessions. Each class was limited to between 15 and 20 men to encourage everyone's participation.

These were no lecture periods, with pupils being "talked at" and learning by rote. They were give-and-take discussions. We presented the facts—our

white line. Committee includes driver's supervisor and representatives of safety department and fork truck training committee.



3 **THREADING NARROW PASSAGE** with 2-in. clearance on either side requires straight approach.

Train Themselves

By A. G. ERDMAN, Superintendent, Transportation and Materials, and S. A. MARINO, Supervisor, Materials Handling Department Monsanto Chemical Company, Plastics Division, Springfield, Mass.

safety record, our high maintenance costs, our cost-reduction efforts and how they were tied to materials conservation. We showed photographs of accidents, damaged truck parts, and damaged packaging, such as torn bags. Then we asked the men what they thought should be done.

At first, we got the kind of off-the-cuff answers you'd expect:

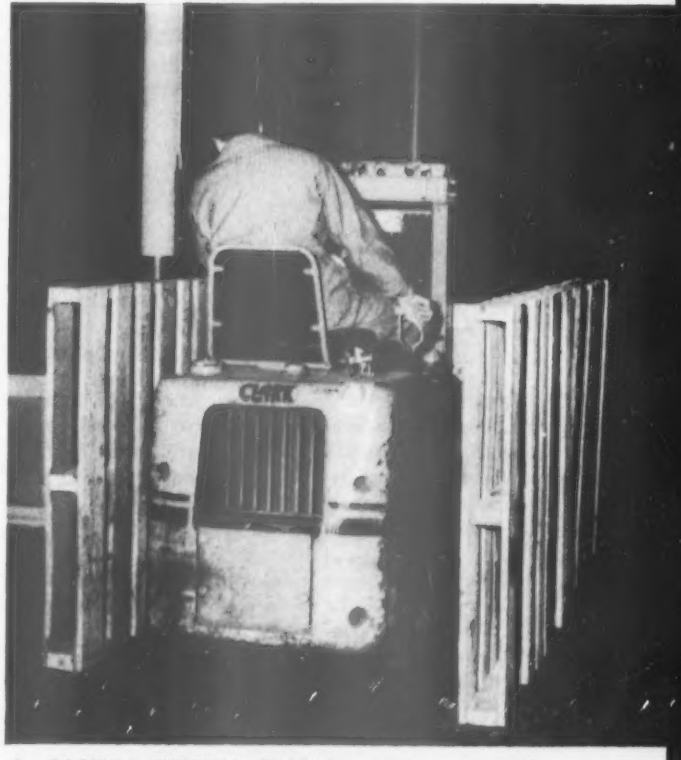
"Truck No. 3 sticks in high speed."

"Truck No. 18 squirts oil into the hoist."

"Aprons on track crossings should be improved."

"Truck No. 2 should have a blinking light that would work when forks are raised above normal traveling height."

But, with a little guidance from us, the men began to see we needed an organized program—not just scattered improvements—to solve our prob-



4 **BACKING THROUGH PASSAGE,** operator watches only one side of truck. Watching both sides would confuse him.

lems. They agreed on the need for enforced operating rules, trained and tested drivers, preventive truck maintenance, and suggestions for better operating practices.

The chief product of our classroom sessions was a booklet of 32 rules—"Fork Truck Operator's Guide" (you'll find them on the page opposite).

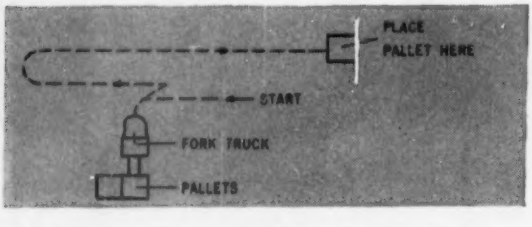
These rules weren't imposed on the operators. They were developed by the men themselves. And that, we think, was a big reason for the success of our training program.

2. IN THE SHOP · Next came a half-hour field demonstration, at which qualified supervisors showed correct ways to operate gasoline and electric trucks. Here again attendance was limited to between 15 and 20 men. By using several instructors and trucks, we gave each operator an opportunity to test his ability and receive individual instruction.

3. FINAL EXAM · Last step in retraining was testing and licensing. All old licenses were cancelled. We examined the operators for new ones 30 days after the demonstration session. This gave the men time to practice proper operating methods.

Each applicant was tested by an examining committee made up of his supervisor, a training committee member, and a safety department representative. He was judged on ease of operation, adherence to safety rules, accuracy in stopping against a line, ability to drive in close clearances, and knowledge of the Operator's Guide.

Our driving test was the same series of maneuvers used in the demonstration session. Here's a sketch:



And here are the instructions to the operator:

1. Pick up stacked pallet, go forward, turn around, deposit pallet against white line. (Shut off power shortly before entering pallet, coast into pallet in one swing, use only brake for final stop, and don't bump load. Set load against white line in one try.)

2. Repeating 1 above, place a loaded pallet next to the one already in position.

3. Performing 1 and 2 in reverse, move the pallets from the white line, and stack them in the original tiers.

4. Drive a loaded truck through parallel barriers with 2-in. clearance on each side of the load. (Perform this maneuver without stopping. Approach absolutely perpendicular to the barriers or the truck will bump them instead of passing through.

5. Repeating 4, back out of passage. (Watch only one side of truck; watching both sides is confusing.)

6. Know all rules in the Operator's Guide, and be able to discuss them intelligently.

Successful applicants got a badge showing they were qualified to operate a gasoline truck, an electric truck, or both. Not all our operators were successful on their first try. On gasoline trucks, 10% failed; on electric trucks, 7.8%. Those who failed received 30-day permits to practice for re-examination.

After retraining our operators, we retrained all supervisors who needed to know how to drive a fork truck. We trained operators ahead of supervisors for two reasons:

1. In our immediate situation, it was important to give operators training priority.
2. It was easier to sell the idea to the supervisors after they'd seen the value of training.

Training Plan for New Drivers

Finally we set up a permanent method for selecting and training *new* operators. Here's how it works:

If the applicant passes a physical examination, he hears a talk by a safety man on safe fork truck driving, truck maintenance, and bag-tearage problems. He also studies the Operator's Guide. He is then issued a 30-day permit, allowing him to gain enough driving experience to pass the test.

Before he starts practice, the trainee sees a demonstration of fundamentals by the qualified instructor in his area—usually his immediate supervisor. During the practice period, he runs a truck under close direction of a trained operator. The degree of direction is relaxed as his ability develops. When he feels he's ready he takes the test already described.

Annual Test for All Drivers

All our fork truck drivers are re-tested annually for operating and physical qualifications. If a man fails either test, his license is suspended until he can pass it.

To pass the physical exam, an operator must:

1. Be in good physical and mental condition—no loss of foot, leg, hand, or arm; no loss of fingers, or other structural defects likely to interfere with safe driving; no mental, nervous, organic, or functional disease likely to interfere with safe driving.

2. Have at least 20/40 vision in both eyes with or without glasses; have minimum field of vision of 170 degrees or 85 degrees on each side.

3. Have adequate hearing.

4. Maintain good equilibrium when feet are placed together with eyes closed; when outstretched on toes and hands.

Fork Truck Operator's Guide

32 Rules for Safe Driving

1. **Try to avoid sudden stops and starts when carrying liquids.**

2. **Do not drive in dark.** Report all poorly lighted aisles or passageways.

3. **Dress safely;** wear safety shoes.

4. **Watch low-clearance signs and signals.** Know the over-all height of your truck and load before entering restricted-overhead areas.

5. **Do not drive with wet or greasy hands;** your hands may slip from controls, cause serious injury.

6. **Keep load as low as possible.** This lessens danger of tipping, lets you see over load when moving.

7. **Report all rubbish, grease, oil, and water on travel routes to foreman.** When possible, don't run over such wastes.

8. **Pick up every load squarely.** This lessens load's chance of slipping while traveling. Spread forks according to width of load.

9. **Keep truck clean**—especially control levers, foot pedals, forks, and platforms—to prevent slipping, which could make you lose control of truck or load.

10. **Don't carry riders.** You're responsible for anyone injured while riding your truck.

11. **Move control levers firmly from one speed to another.** This prevents arcing, which pits contact surfaces of switches. Pitted switches may fail to give expected control in an emergency.

12. **Do not stop suddenly except in absolute emergencies.** Momentum of load may tip over truck, especially when load is elevated.

13. **Use tilting control when carrying loads.** This brings balance of load directly over drive wheel, prevents spilling load when rounding corners.

14. **Make full stop 6 feet in front of elevator gates.** Slow down for bridges, inclines, tunnels, and tracks. Cross tracks diagonally, not at right angle.

15. **When reversing direction, stop electric truck completely** with brakes before you throw reversing switch.

16. **Report controls and units not working properly.** This can greatly reduce over-all truck maintenance costs. It results in minor repairs before strains are put on other parts, causing whole assemblies to fail. Report such conditions as: decrease in normal speed, lack of power, worn or damaged tires, poor brakes, worn wires or short-circuit flashes in controller, and missing guards, covers, and fire extinguishers.

17. **Observe traffic regulations.** Travel through middle of doorways.

18. **Shut off power and set brakes on elevator.**

19. **Start gasoline trucks up inclines by applying power when releasing brakes.**

20. **Block wheels, set brakes, and inspect floors** of motor-truck trailers and box cars before entering with fork truck.

21. **Travel at least 15 feet behind truck ahead of you.** Do not travel two abreast.

22. **Don't park in aisles and doorways** or on ramps and loading platforms. Park with forks down.

23. **Before starting truck, look to front and rear,** making sure there's no one in your path. Always look behind you before backing out from under load.

24. **Before you pick up load, inspect it.** Refuse to haul loads not safely piled. Report all loads exceeding your truck's rated capacity. Remember, you're responsible for a load once it's on your truck.

25. **Sound horn in short blasts when approaching intersections, blind corners, doors, pedestrians.** Short blasts attract attention better than a single long one.

26. **Report details of all collisions and damage** to truck to foreman or supervisor. This helps prevent recurrences of such accidents.

27. **Don't drive through crowded areas during lunch hour or shift changing.**

28. **Report anyone fooling around or damaging your truck.**

29. **If you raise or lower forks while traveling, do so cautiously.**

30. **Always lift with two forks.** Lifting with one fork overbalances truck, may damage truck and injure you.

31. **Never handle inflammable liquids or acids except in approved containers.**

32. **Before loading or unloading box car, be sure bridge plates are properly secured or pinned.** Do not exceed rated capacity marked on bridge plates. Total weight of truck and load should be less than bridge plate capacity.

CASES IN METHODS IMPROVEMENT

Pohl Metal Products Company, Oakdale, Calif.

Better Methods at Bargain Prices

IF YOU'RE LOOKING for better methods that won't knock your budget for a loop, here are seven that may set you thinking. Their price tags range from $28 to $265. Their total cost was $663.

All seven come from Pohl Metal Products, which makes irrigation equipment in a small plant in Oakdale, Calif. FACTORY thinks they'll be of special interest to other small plants and to big-plant maintenance shops.

"Our aim," says Pohl's president, Archie M. Pohl, "was to trim costs and equip the plant, with the least amount of capital tied up in equipment. We started by stressing layout to get a smooth flow of materials between operations, with minimum materials handling using the least possible floor area."

Motion studies helped a lot in locating machines and designing special tools and fixtures to cut costs. Pohl and his production superintendent made the studies. But, he notes, the employees "soon caught on" and began suggesting ways to eliminate waste motion and fatigue.

"We built special tools around standard tools, and converted standard metalworking equipment to our needs," Pohl explains. "It took a little imagination but it paid off handsomely in better quality and lower production and equipment costs."

SLIP ROLLS

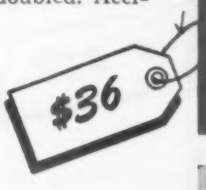
PROBLEM • Hand-operated slip rolls were doing a poor job on one rolling operation. This caused extra work on subsequent operations to keep up quality.

SOLUTION • Rolls were "beefed up" by slipping extra-strong pipe, reamed to proper size, over each one. Grooves were milled lengthwise in back roll to catch edge of stock and start it through rolls. Power was added by installing gear train and wringer gear box from—don't laugh—a junked washing machine. Wringer control gives instant-acting neutral, forward, and reverse—essential to operation. Man who posed for this photo neglected usual practice of wearing gloves.

SLIP ROLLS

PROBLEM • When small parts were run through slip rolls, rolls had to be stopped and opened for each piece. They were unlocked with toggle lever and swung toward operator.

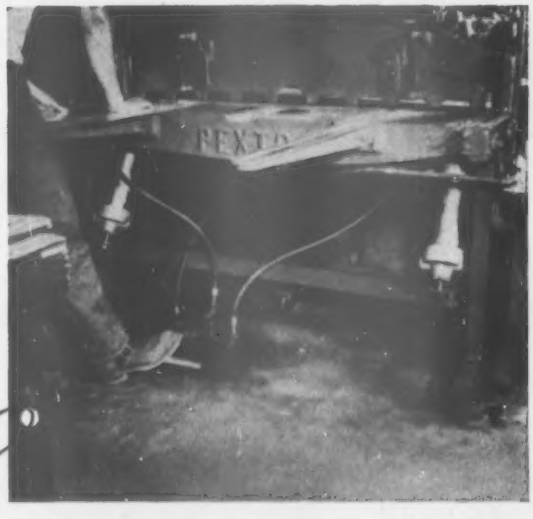
SOLUTION • Clutch installed, with lever in convenient position. Forward movement of operator's right hand closes and locks rolls, engages clutch. Backward movement disengages clutch, unlocks and opens rolls. Production speed doubled. Accident hazard eliminated.



SHEAR

PROBLEM • Foot-operated square shear required two operators at full capacity. Even small cuts were fatiguing for one man. Operation was slow.

SOLUTION • Two air cylinders installed on shear. Controls set up so that both cylinders can be used on heavy material with long, slow stroke; one cylinder can be used for lighter jobs requiring shorter, faster stroke. Small parts are cut as fast as operator feeds stock. Operator is seated for most small operations. Shearing time cut 300%. Operator fatigue reduced.



BEADER

PROBLEM • Turning beader with hand crank was too slow. Faster cranking tired operator.

SOLUTION • Motor and speed reducer installed. Control is by foot-operated power sewing machine clutch. Braking feature of clutch permits rapid starting and stopping of beader. With one hand, operator runs machine. With other, he controls tension on rolls. Time saving, 75%. Excessive fatigue eliminated.

WIRE CUTTING

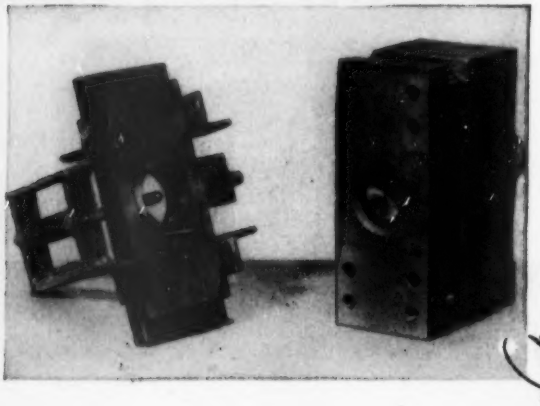
PROBLEM • Hydrant wires cut to length in small press. This required setting up die, moving wire reel. Two men were needed—one to operate reel and feed wire, the other to run press.

SOLUTION • Standard small bolt cutters made into foot-operated fixture, freeing hands of single operator to feed material. Wire guide is curved to conform to bend in wire as it comes off built-in reel. Built-in, adjustable gage permits cutting to length. Operator drops cut lengths into container. Labor halved. Press time saved.

LOCKING SEAMS

PROBLEM • Locking seams on tubes was done by hand with grooving tool and hammer. Operation was slow. Loss due to scrap was high. It was necessary to run all sizes—from 1-in. to 5-in. lengths, from 1-in. to 30-in. diameters—over one piece of equipment to maintain line operations.

SOLUTION • Standard air hammer was built into fixture. Footpedal brings special anvil on hammer in contact with work. Automatic control turns air on and off. Operator's hands are free to feed stock. Simple changing of anvils and stakes adapts fixture to any size. Scrap was reduced to acceptable minimum. Manpower savings run as high as 800%.



FORMING DIE

PROBLEM • Die operations on some small parts required two dies—one to pierce hole, the other to form bead around hole and short flange.

SOLUTION • Single die built to do job. As ram of press starts descent, spring-loaded pressure pad holds material tight over bead on female section. Concave punch then pierces out round slug—spring-loaded pin on female section keeps slug from tipping until piercing is complete. As ram continues descent, taper on punch body forms short flange

PROSPERITY IN THE USA: How Deeply in Debt Are We?

How prosperous *are* the people of the United States? Previous messages in this special series have answered this question in part by recording the progress—relatively slow progress—we have made in increasing both the income and the wealth per person in the USA.

This fourth and concluding piece of the special series deals with the extent to which our prosperity should be discounted because it has been accompanied by an increasing volume of debt. Many correspondents have suggested to us that an individual or a nation can temporarily increase prosperity by borrowing, but in so doing lives on both borrowed goods and borrowed time. Our purpose here is solely to throw light on the question of whether or not we are now in that unenviable position.

On January 1, 1953, the total debt of the United States government and of its citizens was $627 billion, as shown in the table below. On its face, a debt of this magnitude, which represents about $3,900 of debt for each person, suggests that we are heavily debt-ridden.

TOTAL DEBT – PUBLIC AND PRIVATE

Federal government debt	$267	billion
State and local debt	30	"
Private debt		
Corporations	195	"
Individuals	135	"
	$627	billion

The burden of our debts, however, does not depend simply on their size. It depends in much more decisive degree on our capacity to carry the load successfully. This capacity, in turn, is partly a matter of attitude, and attitudes defy objective measurement. A community that gets very jittery about its debts has less capacity to carry its burden successfully than one that does not. But the accurate measurement of jitters, present or prospective, still remains to be mastered.

Capacity to Carry the Debt Load

Nonetheless, it is possible to throw some light on our capacity to carry the debt burden by studying key economic elements that can be measured with some degree of accuracy. The following paragraphs indicate how some of these key economic elements stand.

Compared with our national income, the total volume of our debts, public and private, is still well below the level of 1929, when it proved to be too big for the good of the country. Our total debt is now 113% greater than the national income whereas in 1929 it was 146% greater.

There are several other cheering facts about our debts. One is a sharp decline in interest rates which makes the cost of carrying our debts relatively much less than it was in 1929. It took 8% of our total national income to carry our debts in 1929; it takes only about 5% of the income today.

More Cheering Facts

We also have much more ready cash now than in 1929. Today individuals and corporations hold a total of $269 billion in cash or its equivalent which is almost twice as much as the portion of private short-term debt (about $140 billion) that is subject to sudden demand for payment.

Many students of the subject cite the relatively low cost of carrying our debts and the large volume of cash on hand, and reach the comfortable conclusion that our debt burden is nothing to worry about. In further support of this view they emphasize the fact that no important part of our debt is owed abroad. Hence, they reason there is not the danger, so conspicuous in Britain since the end of World War II, that our economy will be upset by the necessity of making heavy debt payments to other countries.

Some Dangers of Present Debt

However, the nature of our debts presents dangers that it would be foolish to ignore. This is true of both the debt of $267 billion owed by the federal government to its citizens and the $330 billion in private debts owed by some citizens and corporations to others.

Public debt can be a dangerous kind of debt because government has the power to print money or to create its equivalent by expanding bank credit. Of the $215 billion that the federal government borrowed during World War II, over $90 billion was borrowed from banks. This was the largest single contributor to the inflation of prices that since the war has robbed the dollar of about half of its purchasing power, and thereby robbed the buyers of government bonds of about half the purchasing power these bonds were supposed to represent.

If, as is quite possible, a new emergency should again require the federal government to borrow heavily while its debt remains so high, it is doubtful that the public would be avid to buy its bonds. Hence, the government might again be forced to resort to the inflationary process of relying on bank credit.

Private debts can be dangerous if the people take on new debts more rapidly than is justified by the growth of business or by their ability to repay. Last year bank loans were increased by the imposing sum of about $6½ billion, which represents an increase of about 11% in total loans outstanding. This is almost twice as much as the increase in the volume of business over the same period. Installment credit for consumers increased by $3 billion last year, again an increase in debt about twice as great as the increase in business volume in the fields where the credit was used. It is also the fastest rate of such growth in our history.

Constructive Use of Credit

So long as the expansion of credit does no more than keep pace with expansion in the volume of business, the expansion is constructive. Also, when credit is expanded to acquire resources and equipment that will enlarge the volume of business a little later, that use is clearly constructive. But when private credit expansion begins to run ahead of business growth, it is time for us to be heads up. Such credit expansion courts price inflation. It also creates a forced draft under business so that, if credit is cut off, there may be a painful drop.

To give a summary answer to the question: *Is the level of debt in the United States a danger to our prosperity?* — the answer seems to be, "Not at the moment." We owe nothing abroad. The interest burden on present debt is relatively small, and we appear to have the resources to handle the short-term debt. Yet both the total amount of debt and the recent rapid increase in total private debt, especially the latter, are enough to signal for caution. We need restraint on the part of business and consumers to avoid expanding private borrowing at an excessive rate. The federal debt needs to be reduced and put in more manageable form. If these things are done, we can proceed to build a sound prosperity.

McGraw-Hill Publishing Company, Inc.

"Mechanized nomograph,"
Easy to make,
Easy to use, offers...

Faster Way to Figure Economic Lot Sizes

By ROBERT GALLOWAY
Wallace Clark & Co., Inc., New York

MORE THAN 150 lot sizes an hour can be computed by untrained clerk with this "mechanized nomograph."

WHAT SIZE should your manufacturing lots be to give you lowest cost per unit? If they're too small, unit costs shoot up. If they're too large, you're saddled with avoidable interest charges and so-called "bin rental" charges.

How *do* you hit the happy medium—the economic production quantity?

That question is often a puzzler. It needn't be. A simple device like the one shown above will help you answer it. The device—we call it a mechanized nomograph—enables an untrained clerk to compute more than 150 lot sizes an hour.

And you needn't pay a fancy sum for it. If you've never made a nomograph, chances are one of your industrial engineers can do it for you. Then your maintenance shop can turn it into a handy tool. Total cost shouldn't run over $25.

The nomograph itself is a graphical, logarithmic charting of this familiar formula:

$$Q = \sqrt{\frac{2RS}{KC}}$$

in which . . .

Q = economic production quantity
R = annual requirements in pieces
S = set-up cost per lot
K = inventory carrying charge
C = unit cost per piece

Your cost records will give you all factors except *K*, which covers storage costs and interest on money invested in the finished item. Peculiar to your company, *K*'s value can be found by a cost study—may range from 10% to 35% of the unit cost of manufacturing. Your nomograph will be based on a single *K* value, would have to be remade if the *K* value changed.

How to Make the Nomograph

Draw the nomograph. Photostat it up to 17 x 22 inches—or any handy size—and mount it on a sheet of aluminum or plywood. Fasten a clear sheet of Vinylite over the stat to protect it. Cut a slot lengthwise in a clear strip of Lucite. Fasten the Lucite strip over the reference line (A), blocking it up at each end. Fasten a straightedge through the slot so that screwing down on the fastening point locks the straightedge at any position.

How to Use the Nomograph

With the straightedge, connect the values for annual requirements and set-up cost. Screw down the fastener. Pivot the straightedge to the value for unit cost. Now note the point where the straightedge crosses the scale for economic production quantity. That's your economic lot size.

A TOBY QUINT EPISODE:

"Figuring how many bites in a sandwich?"

Filed Under "Beeswax"

By RAY W. SHERMAN

HIS RIGHT HAND held a half-eaten sandwich. With his left Mort McCann gripped a pen and glared at a form headed "Request for Maintenance."

Muttering, he munched and scribbled, wondering if he wouldn't have been happier on "the line" in Central Manufacturing, where he had been for seventeen years till he was upped to foreman of B-L.

"Figuring how many bites in a sandwich?"

With a start, Mort turned to his office door where Red Kane, foreman of H-V and veteran from the plant's baby days, leaned, smiling.

"They'll have us doing *that* next!" Mort threw down his pen.

Parked in the other hard chair, Red picked up the form. "New light in office of foreman of B-L. What for? So you can see to do more paperwork?"

"T'ain't funny, Red." Mort banged the form. "It'll take longer to fill out this form than it will to put in the light."

"So?"

"So?" Mort echoed. "Last guy here was right-handed. I'm left-handed. My hand gets in my light. I need a light right there." He pointed at the ceiling. "So-o-o I phone Jack Dean. Jack says make out a form. I say what's the sense to that when all he's got to do is put in a light."

"Plant engineer says make out a form."

"He says make out a form!" Mort's face was getting pink. "And—"

"And you said 'Oh, nuts!' "

"And I said 'Oh, nuts!' Listen!" Mort snapped. "Who's telling this? You or me?"

Red shrugged. "Beeswax said —"

"Who's Beeswax?"

"Thought everybody knew." Red lifted his once-red brows. "Up in his office he's Jasper N. Beasley, treasurer. Every place else he's 'Beeswax,' father of forms and figures."

"Works nights figuring out forms," Mort grunted.

"Beeswax is all right," said Red. "None better. Weren't you in the foremen's meeting when he talked about paperwork?"

"Meeting? Paperwork?" Mort shook his head.

"Maybe it was before you were foreman," said Red. "He was good — really."

"Wha'd he say?" Mort poured a cup of coffee.

Red thought a moment and shot out: "What does it cost to make a Model Q?"

"How in heck should I know?" Mort snapped. "That's what we foremen told Beeswax."

"Yeah?" Mort laughed. "How'd he like that?"

"And Beeswax asked us if somebody shouldn't know the cost before they put a price on it. He sort of had us there." Red grinned. "Then he asked how he could know unless he had some figures. About then nobody was saying much. And then he asked us how he was going to have any figures unless somebody gave him some. And that if nobody gave him any he might set the price too low and next thing Central would be busted and there wouldn't be any foremen."

"Hm-m-m." Mort was busy with a piece of pie.

"So," Red went on, "he said there was *a reason for every goldarned form in the plant* and he asked us to take his word for that and fill 'em out. If any foreman was so overworked he couldn't, they'd hire a helper for him. But he'd have to prove it was overwork and not just gripe."

"But this form." Mort tapped the blank. "I could put in the lamp myself—"

"I forgot," said Red. "That lamp goes into the cost of the Model Q. So—you keep a copy—Jack gets a copy—Beeswax gets a copy —"

"And they file 'em," said Mort.

"One other thing—" Red rose to go. "Know the difference between a foreman and a worker?"

"Headaches?" asked Mort.

"Nope," said Red. "A foreman has an office and a file. Take away his file and he doesn't need an office. So, put stuff in it. The more the stuff, the better the foreman. Finally it gets so full you ask for another file. Then you're tops! And how're you going to fill a file if you don't do paperwork?"

Mort eyed Red's deadpan face. "Beeswax said that?"

"Well, not exactly." Red was edging toward the door.

"Your file, Red—" Mort rose, too, at the whistle "— can you ever find anything in it?"

"Of course I can!" Red barked. "A place for everything and everything in its place."

"OK." Mort held up the form. "How would you file this? Request, maintenance, lamp, or what?"

"Oh, that?" Red waved airily at the form and eased out the door. "That's a cinch! Anything to do with expense I put in a file called 'Beeswax.'"

Look through the back pages for . . .

. . . **Important New Catalogs.** Useful on your job. Free. Just check the coupon and mail it to us. We take it from there. **Page 154.**

. . . **Maintenance Pointers.** How telephones speed cleaning of underground tanks. Other new methods for plant engineers. **Page 160.**

. . . **What's New in Equipment.** Mobile workshop rolls to the job, carries everything your maintenance men need. It's one of scores of just-out's described here. **Page 162.**

. . . **Practical Labor Relations.** Significant labor developments through the eyes of an experienced negotiator. **Page 226.**

. . . **Plant Engineering Problems.** Hints on solving them. For instance: What to do if fasteners are the weak link in your corrosive fume exhaust system. **Page 250.**

. . . **Plant Operating Problems.** Want the latest dope on using molded nylon materials? It's here. Also ways to lick other plant operating problems. **Page 254.**

. . . **You Mustn't Miss.** How can you cope with the shortage of engineers? Can you cut production costs by combining welding and forming? Answers begin on **page 276.**

. . . **Books and Booklets.** A guide to current reading that helps you on your job. Leads off this month with review of John Diebold's "Automation," a book that sparks your thinking about the "factory of the future." **Page 316.**

. . . **Industrial Films.** Terse reviews, pitched to your needs. In this issue, a film series showing practical employee relations programs. **Page 326.** (*See also "Good Employee Relations in a Small Plant," p. 102.*)

. . . **Behind the Byline.** Photos and thumbnail sketches of FACTORY authors. **Page 336.**

Missing . . .

FACTORY's "reading test," a regular monthly feature since October 1951 (when we published "How to Read Faster and Better"), has been omitted from this issue. Has this test served its purpose? Shall we drop it for good? Or do you want us to continue its publication? Address The Editor, FACTORY, 330 W. 42nd St., New York 36.

FIRST SHEET of VPI paper is dropped into upright carton. It's one of three sheets used to protect part from rust.

WITH SECOND SHEET wrapped around its middle, part (a fork connecting rod) is lowered into carton.

THIRD SHEET is laid over end of rod. Cardboard spacers are inserted to keep rod from shifting.

No oil. No grease. GM's Electro-Motive Division uses VPI paper to . . .

Halt Rust in Parts Shipments

By R. C. LAMBRECHT • Manager of Parts Warehousing, Electro-Motive Division, General Motors Corporation, La Grange, Ill.

COSTS PYRAMID when rust attacks packaged steel parts. That's obvious. But how do you stop it?

Some plants use rust-preventive oil or grease in packaging. In our case, the enormous sizes and weights of our diesel engine parts forced us to seek an answer that did not involve the use of conveyor-mounted dip tanks or similar equipment. In fact, we use no oil or grease in packing the 11-million pounds of parts shipped monthly from our depot.

Instead, we fight rust with a corrosion inhibitor called VPI (vapor phase inhibitor). We use VPI paper to wrap parts ranging from a hair spring to a 60,000-lb. truck assembly.

Has it paid off? It sure has. Formerly rust often attacked parts during shipment and storage. Now, if a part is rust-free when packed with VPI paper, it stays rust-free.

For our purposes, VPI is coated on paper, which serves as a carrier to control the chemical. VPI is a practical, economic rust preventive because:

- **It has low volatility at atmospheric temperature.**
- **Its vapor migratory action carries it to all parts of a surface to be protected.**
- **It works even better in the presence of high humidity, where condensation forms water.**

PAY-OFF • Switching from rust-preventive oil and grease to VPI has sliced our costs in three ways:

1. **Wiped out large losses caused by corrosion.** We're no longer spending dollars and hours to replace or reprocess rusted parts and then repack and reship them.
2. **Simplified the rust-proofing process.** Labor

CARTON IS SEALED. Connecting rod is now protected from rust indefinitely, or until carton is opened.

and parts handling have been greatly reduced. Less handling of parts lowers chances of damaging them.

Formerly parts went through caustic washing, a finger-printing solution, oiling, and then either a 24-hr. waiting period to dry the oil or quicker drying under an infra-red lamp. Now they're taken right from production lines and packaged.

Most important, our change from oil and grease to VPI has also saved our customers time and money. Customer railroads used to spend at least 1 man-hour degreasing a single cylinder assembly.

3. Lowered packaging and shipping expenses. Grease soaks into cartons, deteriorating them; VPI doesn't. So we've replaced wooden boxes and metal cans with cartons and drums, which are less expensive and, being lighter, cost less to ship. And we've come up with savings like these:

- Fork rod, once shipped in a wooden box costing $3.40, now shipped in an 87¢ carton.
- Accessory drive gear, formerly packed in a $3.85 wooden box, now goes in a $1.33 carton.
- Fuel injector, formerly requiring a $4 can, now sent out in a 29¢ carton.

All this cost cutting adds up to some whopping figures. For instance: In packaging diesel engine cylinder heads and cylinder liners alone, annual savings total nearly $300,000. Savings like these are one reason why we've been able to hold the line on — and even reduce — parts prices despite rising material and labor costs.

HOW WE'VE LEARNED

Our switch to VPI was gradual, the result of five years of testing and commercial experience.

In a typical early test, we wrapped 36 exhaust valves with VPI paper in reverse tuck cartons, stored them outside our warehouse for a month, then shipped them to Coral Gables, Fla., for more storage. Directly exposed to salt air but not to rain, they were returned at a rate of nine every three months until a year had expired. All came back in perfect shape.

WHAT WE'VE LEARNED

Tests and actual practice have shown us that:

1. VPI vapor gives full protection up to 12 inches from its source. So parts needn't be actually wrapped in VPI paper. Instead, we simply bunch the paper around them, making sure it won't work loose and is no more than 12 inches from the rust-vulnerable surface.

Here's how to protect a 42-in.-long fork connecting rod: Place a carton on end with the top end open. Drop an 18 x 18-in. piece of VPI paper into the carton. Wrap another 18 x 18-in. piece around the center of the rod as it's lowered into the carton. Lay a third piece over the end of the rod and close the carton.

That's how simple wrapping usually is. But there are exceptions. Some parts are wrapped more completely to prevent chafing against the carton or loose sections. A few small parts are rolled in paper—but for neatness only. Wadded paper in one end of the carton protects as well.

2. VPI doesn't rule out all chances of rust. The vapor takes about two hours after a package is closed to migrate to all metal surfaces. But in this length of time, rusting in a closed package is highly improbable.

3. VPI doesn't require an airtight carton. Tests prove that a fan blowing directly on a piece of VPI would have to move 1300 cubic feet of air a minute for 13 hours to dispel 70% of the VPI strength.

4. VPI's effectiveness in water has practical limits, although it goes into solution fairly easily. Generally speaking, VPI will prevent rusting after it has been in water at least two hours.

But a water-soaked carton would probably soften. Then the water would run out, taking the VPI with it. So VPI's effectiveness actually hinges on how much water gets at the parts and how much VPI vapor stays in contact with them.

We're still testing, still finding new ways to use VPI. For example: To protect the critical area inside a locomotive engine cylinder, we put a small bag, containing two grams of VPI crystals, in the cylinder after removing the injector.

And why limit VPI to packaging? Why not use it to protect seldom-used tools in the toolroom, to preserve delicate parts during in-process storage?

TIPS TO GOOD HUMAN RELATIONS for factory executives

By M. J. MURPHY • Industrial Relations Editor

SURE-FIRE INTEREST-GETTING DEVICE Here's something to store away for the day when you want something really "different" to stir up a lot of interest in some project you want to promote good and hard: Send employees a message about the project. But make em work to read it—by making it a "secret message" in invisible ink! Yep, it really works. In fact it won first prize for the McBee Company, Athens, Ohio, in a nation-wide contest conducted by the National Association of Suggestion Systems. McBee sent all employees a "secret message" in invisible ink, urging them to submit ideas for improvements of production or operating methods.

This is a good idea for safety and other types of promotions, too.

YOUR DECISIONS—WHEN ARE THEY IMPORTANT? Next time you're sweating over a really tough problem, debating which of two or more courses of action to take, here's something that may make you feel better. The author has government decisions in mind, but the basic idea applies as well to business:

"The consequences for general economic welfare of most government decisions has been imperceptible. The first reason is our nearly universal tendency to confuse close decisions with important ones. The most difficult decisions are, normally, the least important. They involve a choice between courses of action which are almost equally favorable—or, on occasion, almost equally unhappy. Different men assess the effects of the alternative courses of action differently and the very closeness of the outcome causes them to marshall their arguments elaborately. . . . Infinite benefit is pictured for one course, utter disaster for another. Were the choice, in fact, between great good and great damage, the decision would not be debated." (Quoted from John K. Galbraith, *American Capitalism—The Concept of Countervailing Power,* Houghton Mifflin Company, page 112.)

"FORMULA FOR FAILURE" This formula comes from a man in retailing, but it will work just as well in manufacturing: "Use your authority whenever you can, and try to make people toe the mark you set. Tell them what they must do; be sure they won't do it willingly or well—and you'll have a straight road to failure as a leader."

Said by John J. McCarthy, of Gimbel Brothers, talking to a group of students at City College of New York.

More Tips on page 152

Remington Rand Methods News

Three ways to untangle snarls in your production scheduling

Take the case of a plant where snarls developed about a year after it had been modernized. Suddenly orders backed up in the shop. Some machines had a big backlog while others were idle. Production control methods were out of mesh somewhere. But where? The production men were stymied when it came to overhauling the record-keeping methods.

Plant officials decided to call in Remington Rand for professional counsel. A preliminary study showed the problem went much further than machine-load scheduling. So our management engineers were authorized to dig deeper.

In their final report, these engineers proposed simple answers to each problem uncovered – all coordinated into a revised control system that soon eliminated snarls in machine loading. In fact, within three years this system was processing a doubled plant output with same smooth-working efficiency.

Let us give you the full case history of this plant's experience with *an outside viewpoint* to help simplify control methods. Ask for folder **CH-724.**

Or take the case of the big production snarl caused by a small part – because it is the wrong part. Poor description of parts causes all kinds of plant headaches: assembly delays, duplicate stocks, high paperwork costs.

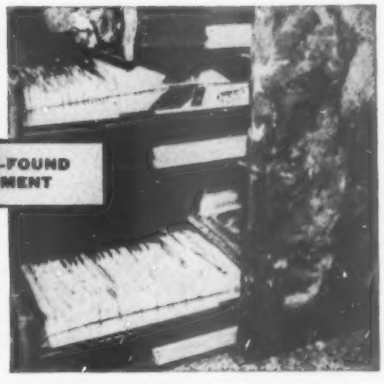
But the remedy is simple and sure: identify and classify each item properly, so it can always be referred to by exact number. Recoding your parts and materials may cost less than you expect. Our engineers have built up a special library of standard nomenclature and numbering systems which can be readily adapted to your coding problems. For details, see **BSD-10.**

Another case is the production snarl caused by out-of-date control figures. When your clerks are not able to keep all records current, it's time for you to look into new ways of producing the figures. Many firms use our punched-card record services to get figures faster, at lower cost, for materials control, machine loading, costing, etc. See **BSD-6.**

GET A PRIVATE SHOWING OF NEW SOUND SLIDEFILM ON PRODUCTION CONTROL

It will be 23 minutes well spent for your key executives who get to see this brand new film on efficient coordination of men, machines and materials. Shows you practical methods for speeding a new schedule into actual production, holding down the materials inventory, spotting the bottlenecks before they happen, and adjusting a schedule to new conditions. Check coupon below for showing at your convenience.

RECORDS LOST. Here the loss of $40,000 in plant and equipment was covered by insurance. But the uninsured records of all orders in production were also destroyed. The firm paid heavily in both time and money to reconstruct these records. Such a fire always comes when least expected. The loss in records often exceeds the building losses. What would happen to *your* in-process papers?



RECORDS FOUND. Here, on the morning after a five-hour plant fire, all vital operating records were found intact. Though other files were completely destroyed, these papers survived in perfect condition. Remington Rand Safe-Files provided insulated protection *at the point of use!* This certified protection is also available in Safe-Desks and Safe-Cabinets. See actual case history RG-552.

Visible tool records cut production costs in this plant by accurate control of tool charge-outs and reordering points.

A new tool crib system won't cost you a penny!

A rush request comes in for a tool. If the tool is not there, work must be rescheduled. That's when you need tool-crib control that really works.

In plant after plant, a small investment for a 100% system has shown a big profit in: 1) assured availability of tools to meet production schedule needs; 2) numerous tangible savings on tool inventory, purchasing, repair, and losses; 3) reduced tool crib personnel.

Yes, it's actually easier, takes less work, to maintain *complete* control over tools than to rely on outmoded or makeshift routines. A Remington Rand tool crib system keeps paperwork at an absolute minimum . . . simplifies filing and finding of records by tool and by worker . . . gives your tool supply status in a *visible* picture by item.

It will pay you to study tool control forms and procedures now used in hundreds of plants, easily adaptable to your special plant needs. Ask for methods folder **KD-641.**

Remington Rand Inc.

Management Controls Reference Library
Room 1759, 315 Fourth Ave., New York 10

Please circle the literature you desire:

CH-724 **BSD-10** **BSD-6**

☐ **Production control film showing**

RG-552 **KD-641**

Name_____

Title_____

Firm_____

Address_____

City_____

P-11

LOW COST FILMS TRAINING FOR INDUCTION

Here's some information you may find really handy if you'd like to spruce up your induction of new workers with films. It comes from Training Director Bill Gilman, of Brush Development Company, Cleveland.

Brush found it could use colored slides and a tape recorder to put together an excellent presentation at low cost. In comparing costs, it found that a 35-min. sound film in color might cost $40,000 and become obsolete in as little as three years. The slide presentation, on the other hand, cost only $1925, complete with all projection and recording equipment.

One feature of Brush's equipment is an altered tape recorder that automatically causes the projector to change slides at the right times.

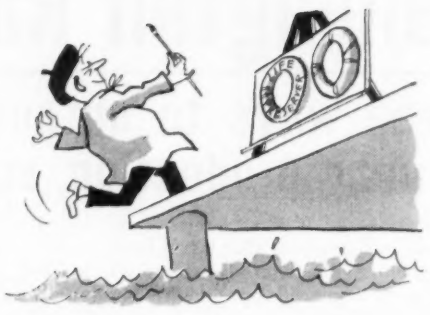
Biggest advantage in using slides and sound tape is that new slides can be substituted and tape can be spliced as events require updating of the presentation. And, when desired, the slides and tape can be reprogrammed.

If you're interested, Brush will tell you what equipment they use and how to wire the recorder. Write Bill Gilman, Training Director, 3405 Perkins Avenue, Cleveland, Ohio.

PUBLIC RELATIONS HEADWORK

Here's FACTORY's nomination for a public relations "Oscar" for ingenuity—to be awarded to Caterpillar Tractor Company. Caterpillar's idea: Why not harness some of the wasted conversation of hometown barbers in Peoria, Ill., for the company's benefit?

Result: A special Caterpillar Barber's Day attended by over a hundred local barbers on one of their Wednesday days off. They visited the plant, listened to and quizzed company executives, had lunch, saw some company movies. By the end of the day, they were well supplied with food for conversation about their visit for many a day—and for many a customer at the traditional barber-chair listening post. Everybody liked the first day so well (it was held two years ago) that another's now being planned.



WATERFRONT SAFETY

If your plant borders on water, here's something you can do that will be appreciated by employees and neighbors. Won't cost anything to speak of, either; just put up a number of life preservers along your section of the waterfront. Otis Elevator Company does it at two plants—Harrison, N. J., and Yonkers, N. Y.—both bordering water. Only had occasion to use them once, Otis reports, but they're a constant reminder of company interest in employee and community safety.

NEW KIND OF EMPLOYEE MAGAZINE

Ever think of publishing your employee magazine in paid advertising space in your local newspaper, instead of the way you do it now? Sounds far fetched? Maybe, but it's working fine for the Geo. D. Roper Corporation, of Rockford, Ill. Every month this company puts out the "Roper Round-Up" on a full page of the local paper. It has the same "feel" and content as material you see in many employee magazines, including lots of pictures. It gets to employees equally well, but also reaches a vast audience in the community. They get a glimpse into the company's employee relations that no commercial advertisement could ever give.

Is something like this practical for *you*? Here are some answers by Newcomb & Sammons, Chicago public relations consultants who researched and developed the idea for Roper:

1. It's much cheaper and more timely than the usual house organ.

2. It gets a much bigger audience—important if you want to develop better community relations, too.

3. You ought *not* to try it if you're in a big city. Newcomb & Sammons suggests it's best for communities of less than 100,000.

Will it put employee-magazine editors out of work? No, indeed, say the consultants, who predict a "bright future" for the whole idea. Should make more jobs because more companies should be able to afford a publication.

No Pressure Wipe-Off on Gears Lubricated with Sun 897 Grease

Even heavy tooth loading won't cause Sun 897 Adhesive Pressure Grease to squeeze out. It stays on the gears, prevents metal to metal contact, prolongs gear life, and reduces lubrication costs. Sun 897 is most valuable where *throw-off* with resultant wear and spotting of products must be avoided. It is easily applied with a brush on open gears, sprockets, chains, slides, cams, cables, couplings and linkages. For complete information, consult your nearest Sun representative or write Department F-3.

SUN INDUSTRIAL PRODUCTS
SUN OIL COMPANY • PHILADELPHIA 3, PA.
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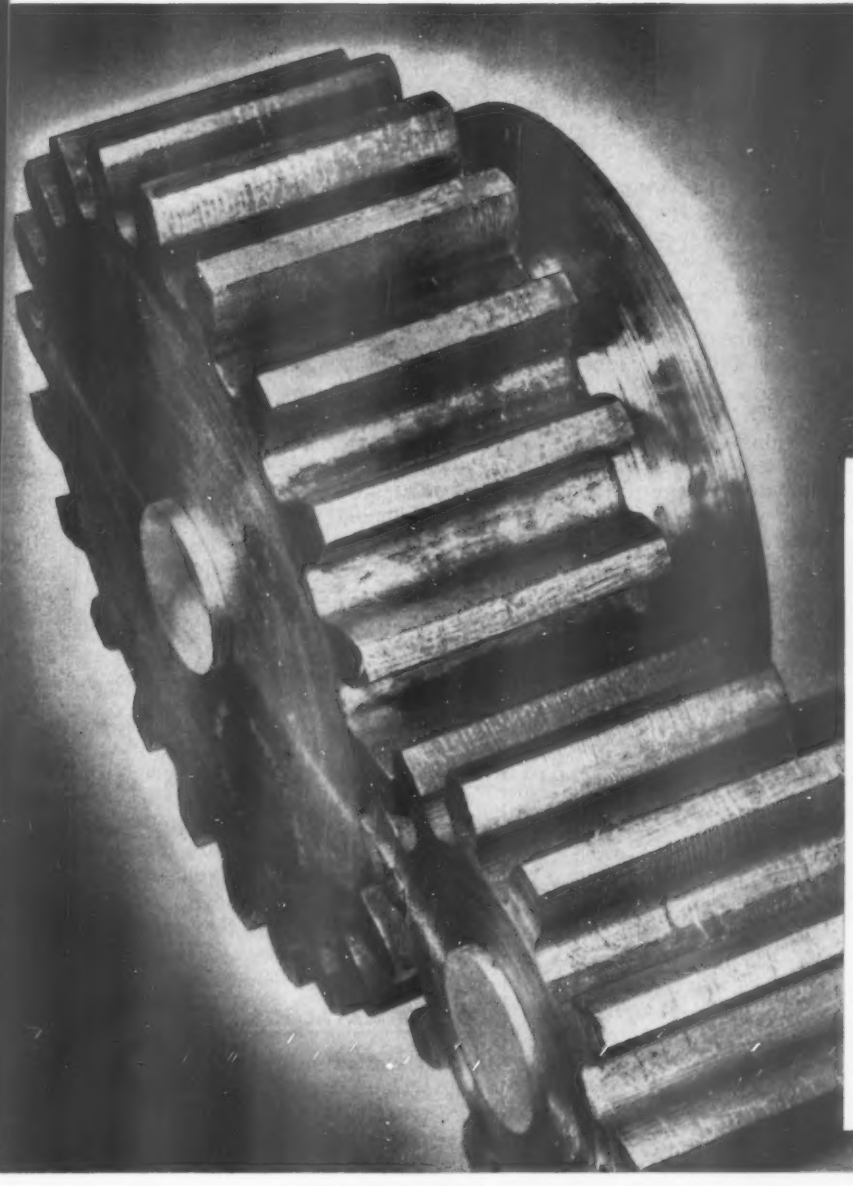

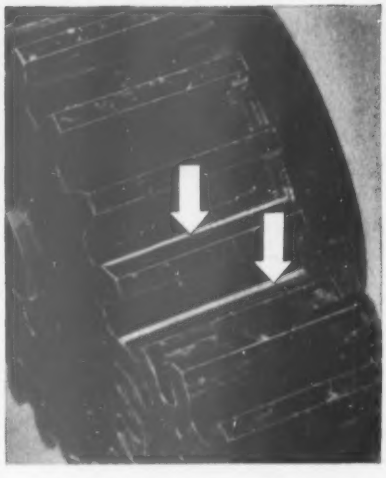

BLACK GEAR COMPOUNDS oxidize, harden and wipe off quickly under pressure. Arrows indicate where wipe-off of the compound has left the gears unprotected by a lubricant. Metal to metal contact causes excessive wear and thus materially shortens the life of gears.

NO SQUEEZE-OUT due to pressure. A thin, transparent film of Sun 897 Adhesive Pressure Grease stays evenly distributed on the gears and gives positive lubrication at all times. Sun 897 is water resistant and can be easily applied with a brush.

Need help with your problems?

IMPORTANT NEW Free CATALOGS

. . . they're the cream of this month's crop . . . They describe latest methods and equipment. Tell us which ones you want. Use the handy coupon at the bottom of the page. If somebody beat you to it, there's another on page 249.

BUILDINGS

1 Rolling Doors
"Saving Ways in Doorways" is title of this 32-page catalog (No. 75). Describes steel rolling doors, fire doors, overhead doors, and other types. Specifications and photographs. Data on electric operators. Kinnear Mfg. Co.

2 Utility Buildings
You get detailed drawings, charts, photographs, and other descriptive material on factory-produced building units that you can adapt to your needs. Erection information, section on dimensions, and list of styles. 24 pages. Soule Steel Co.

3 Glass
In catalog No. 35 you'll find information on translucent, structural, wired, heat-absorbing, and glare-reducing glass. Tells when to use each, gives specifications. Light distribution charts, other technical data. 16 pages. The Mississippi Glass Co.

4 Paint
You learn about ease and advantages of covering plant interiors with a one-coat white paint. Features, directions for applications, coverage and drying-time data. Describes other paint products and gives recommendations for their use in plants. Bulletin No. C 111. The Arco Co.

5 Roof Insulation
Here are features of maker's fibrous - glass roof insulation. Gives insulating properties, describes how to apply on new or old buildings. Photographs of many installations. Owens-Corning Fiberglas Corp.

6 Movable Metal Walls
This 48-page catalog tells how you can use a variety of metal wall sections to provide flexible layout in plant and office. Illustrates and describes partitions for special applications. Specs and construction details for each type. Catalog No. 53. The Mills Co.

7 Toilet Compartments
Catalog No. 90 is complete guide to selecting maker's toilet compartments. Describes colors available, gives specifications. There are construction features and installation data. Also photographs, sections on shower stalls and hardware. Typical floor plans. 20 pages. The Sanymetal Products Co., Inc.

DUPLICATE COUPON ON PAGE 249

MAIL THIS COUPON FOR FREE CATALOGS *(Good until May 31, 1953)*

FACTORY MANAGEMENT & MAINTENANCE (March 1953)
330 W. 42nd St., New York 36

I'm circling the numbers of the catalogs and bulletins I want:

1	2	3	4	5	6	7	8	9	10	11	12	13
14	15	16	17	18	19	20	21	22	23	24	25	26
27	28	29	30	31	32	33	34	35	36	37	38	39
40	41	42	43	44	45	46	47					

Name ..... Title .....

Company .....

Street Address .....

City ..... Zone ..... State .....

OTHER CATALOGS

MATERIALS HANDLING . . Page 242
AIR HANDLING 244
CONTROLS 246
ELECTRICAL EQUIPMENT 246
MISCELLANEOUS 249
PLANT ENGINEERING 250
PLANT OPERATING 254

ALEMITE OIL-MIST

extends bearing life 11 times!

Steel Maker saves

$220 per Week.

Eliminates Lubrication Downtime

High-speed bearings on a key production machine burned out regularly—*week after week.* Tedious hand lubrication, man-hours for repairs, machine downtime, and cost of new bearings piled up. To end this expense, the company turned to Alemite—installed Oil-Mist equipment costing little more than a hundred dollars. *Result:* A savings of $220 in the first week. Today—after 11 weeks of operation, the bearings show *no sign of wear;* only 3 ounces of oil are used per shift where a pound and a half of grease were required before!

Facts prove this *"Friction Fighter"* most efficient, continuous, fully automatic lubrication system

Again, Alemite proves world leadership in lubrication with Oil-Mist, the system that *atomizes* oil into mist—distributes it through tubing to bearings—bathes all bearing surfaces with a cool film of clean oil. Amazingly efficient, the lubricator has no moving parts—and, the human element in lubrication is removed.

Thoroughly tested in countless applications throughout all industry, Oil-Mist—as facts prove—uniformly maintains oil film on plain and anti-friction bearings, gears and chains despite variations in load, temperature or speed. Don't you owe it to *your* business to learn all about Alemite Oil-Mist—*today?*

ALEMITE OIL-MIST Lubricates All Types of Mechanisms

Alemite OIL-MIST Lubrication

A PRODUCT OF SW STEWART-WARNER

Compare all these OIL-MIST advantages with *ordinary* methods!

- Reduces bearing temperatures as much as 20%.
- Continuous, uniform lubrication of all types of bearings.
- Air pressure seals bearings against dirt.
- Reduces oil consumption—up to 90%.
- Prevents product spoilage.
- Eliminates guesswork—each bearing picks up as much Oil-Mist as it needs.
- Reduces starting and running torque.

Get the facts NOW!

Alemite, Division of Stewart-Warner, Dept. G-33
1850 Diversey Parkway, Chicago 14, Illinois

☐ Please send me a FREE copy of your new and complete Oil-Mist Catalog.

☐ Please have your Alemite Lubrication Representative arrange a desk-top demonstration of Oil-Mist. This entails no cost or obligation on my part.

My name .....

Title .....

Company .....

Street .....

City ..... State .....

JOE'S DEPARTMENT

ELECTRICAL IDEAS EVERY PLANT MAN CAN USE

By JOE ST. ANDRE • Electrical Editor

• SOME CUTIES I PICKED UP AT THE POWER SHOW

Hope you all got to the Power Show in New York. It was a dandy. I for one came away with several new wrinkles that will help the plant electrician:

• One controller manufacturer has come out with an auxiliary contact that can be mounted very easily on the solenoid arm of the motor starter. You are always in need of "another" contact to operate an indicating light on some remote board or maybe some lockout device. This new device can be either used as an open contact or closed contact.

• The same manufacturer paints the inside of starter cabinets white. A small point, I know, but you should see how every detail of the starter stood out in the dimly lit section of the display board. You don't usually have 100 foot-candles on your motor starters, either. So it might be a good thing if you painted the insides of *your* starter boxes. Then you wouldn't have so much trouble finding that screw-hole when you're installing a new solenoid coil.

• I saw a new selector switch that really selects. With this switch and only *one* contactor, it is possible to control a number of motors from one switch. You can start and stop all the motors at one time. You can also start and stop any one motor without affecting any of the other motors. You can reverse any one of the motors. You can jog any one motor. All this with one switch.

• A motor starter that mounts in place of the terminal box on a motor helps cut down installation costs.

• An adjustable-speed motor drive using magnetic amplifiers instead of electronic tubes for control is now available. For the plants where electrical maintenance men are afraid of electronics, this drive should be the answer.

• Another adjustable drive—but this time for fractional-horsepower motors — provides a wide stepless range of motor speeds from 35 rpm. to 3500 rpm. Using a d-c series motor operating from a single thyratron tube, you can get good speed control with all sorts of varying loads.

• There was also a fantastic device on display that's used for process control and product inspection. By means of a telephone dial, this machine does a lot of things:

1. With one instrument you can read a number of similar variables such as temperatures, gas contents, flow of materials. All the operator has to do is to dial a particular number sequence and up comes the reading. Press a re-set button and you're ready for the next reading.

2. Add a recording system and this is what you now can do. Take 100 readings in ten groups of ten. Use a pushbutton and the same telephone dial and you can connect any group of ten readings to a ten-point recorder which then permanently records all ten variables at one time.

3. Another system will automatically connect a large number of variables in sequence to a single measuring device. You can either read these variables or record them each in turn. Limits may be set up on each variable so that alarms will sound if allowable limits are exceeded.

4. The granddad of all the above systems does all the above. In addition, upon sensing an abnormality for any of the variables, the machine will operate corrective devices for safety or productivity.

This machine takes the human element out of your continuous processes or automatic equipment. It never sleeps. Never has a Monday morning hangover. I talked to the engineers at the booth and they showed me enough of the components that go to make up this machine to prove that they designed it not only for results but with the maintenance man in mind.

• IT ALWAYS PAYS TO READ MAKERS' INSTRUCTIONS

The other day I was talking to a cable manufacturer about some of his problems. He was really burned up.

"Joe," he said, "Why do people that install cable seem to think they know more about cable than the people who make it?"

"I'll bite," I said. "Why do they?"

This is his sad tale.

His company got an order to make up a cable for a plant. Now this cable was not so special, but it did offer a problem in termination and splicing.

When the cable was shipped, large tags were tied to each end. The cable reels were plainly marked, calling attention to the fact that special instructions should be read before installing the cable. That wasn't all. Additional instructions were

DOW CORNING SILICONES

make motors last longer

COURTESY LAKEY FOUNDRY AND MACHINE COMPANY, MUSKEGON, MICHIGAN.

Saves $4500 in rewind costs; outlasts Class A 36 to 1

Engineers at the Lakey Foundry and Machine Company installed a 5-foot induced draft fan at the top of their core oven stack. It exhausted volatiles from the oven so effectively that a resinous deposit built up on the fan blades. This overload, combined with ambient temperatures in the range of 350°F, limited the life of the Class A insulated 7½ hp TEFC motor driving the fan to a month or less.

Life for the motor was further complicated by occasional flash fires that burned off the resinous deposit and melted the aluminum blades. And the cost of getting the motor out of the stack was greater than the rewind costs.

So, the motor was rewound three years ago with Class H insulation made with Dow Corning Silicones. New bearings lubricated with Dow Corning 44 Silicone grease were installed, and the motor was hoisted back into the stack. It has been operating steadily ever since, in spite of all obstacles including 4 stack fires. Savings in rewind costs alone amount to over $4500 at a conservative $125 per failure.

LUBRICATE HIGH TEMPERATURE BEARINGS WITH DOW CORNING 44 GREASE

In open or single shielded bearings designed for high temperature operation, Dow Corning 44 has many times the life expectancy of conventional greases. It gives life-time lubrication in permanently sealed cartridge-type bearings.

That kind of performance in installations all over the country proves that Class H Insulation has 10 to 100 times the life expectancy of the next best class of insulating materials. It can also be used to increase the output of certain motors by as much as 50%.

mail this coupon Today

DOW CORNING CORP., Dept. L-3
Midland, Michigan

Please send me:
- ☐ Performance data on Class H equipment.
- ☐ List of Class H motor repair shops.
- ☐ Data on Silicone Grease for motor bearings.
- ☐ 32-page booklet entitled "What's A Silicone?"

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MIDLAND DOW CORNING CORPORATION MICHIGAN

Atlanta • Chicago • Cleveland • Dallas • New York • Los Angeles
Washington, D. C. • In Canada: Fiberglas Canada Ltd., Toronto • In England: Midland Silicones Ltd., London

sent to the customer. The manufacturer also offered to have an engineer present to assist in the installation.

You guessed it. First time the manufacturer heard about the installation was when he got a call from the customer that the so-and-so cable had failed —and had also damaged the switchgear to which it was attached.

Investigation revealed, of course, that the instructions had not been followed in the installation. The electricians had been in the business for 35 years. *They* didn't need any sliderule engineers to tell them how to install cable. So down went the plant with resultant loss in production and damage to equipment.

To try and avoid similar trouble in the future, the manufacturer is attaching gummed labels every few feet along the cable. The electricians can't possibly miss them. They're good and red, the type is good and black. It reads in large capital letters: "Read attached instructions before splicing or terminating this cable." He hopes that somehow the electricians will read them and will also read the instructions. I don't know. But it's a good try.

The problem is one of education. If you do your own construction work in your plant, it will pay you to send one of your electrical men to the manufacturer to get the details from the men who make the cable. If the installation is by a contractor, insist that proper instructions be read and followed. Remember, it's your plant. Cables are put in for a long time, so it pays to be sure they are installed properly.

• ARE YOU GETTING THE MOST FOR YOUR POWER DOLLAR?

The Society for Advancement of Management (SAM) in Philadelphia has a live-wire maintenance section. I attended one of its meetings not so long ago. The subject for the evening was "Power Bill Calculations."

The power bill in plants today is getting a lot of attention. Management always thinks it's too high. And sometimes it takes a lot of talking to convince the brass that they're getting their money's worth.

Just how much do *you* know about the way your power bill is calculated? You may be surprised how much savings can be realized by power factor improvement, correct rate schedule, and, of course, by riding herd on demand.

Your local electric company can show you how. But you may have to go to them for this assistance. After all, a company like Philadelphia Electric has more than a million customers who have to be billed every month. You can't expect your power company to have the personnel available to check every bill for you and see where savings can be made. But it will be glad to have one of its engineers sit down with your operating men and work out the best possible way for you to get the most out of your electrical power.

Next month I'll go into details on what you can do along these lines.

• WHEN OFFICE MOVES ARE IN THE OFFING

Don't make a move—office move, that is—without letting your electrical engineer in on the ground floor. All too often he is the forgotten man.

"Why does he have to get into the act?" I can hear you asking. "We aren't moving any machines or changing our power requirements."

But what about outlets for electrical typewriters, adding machines, business machines, and computors? Does your layout take location of outlets into consideration, not to mention construction problems involved in putting in more outlets?

You want the office to look neat and orderly, don't you? No unsightly dropcords are to be permitted. The safety department frowns on extension cords, especially across aisles. How then do you plan to feed power to the above-mentioned office machines?

You start with proper layout. Get your electrical engineer to sit in on preliminary layout plans. And I mean *preliminary* plans. When you hand him a blueprint that already has been discussed with every secretary and typist as well as supervisors and other officials, how can you expect him to have the nerve to battle all those women to get the plans changed? Just remember you're going to pay through the nose—in high costs for electrical work—if you let the personal whims of a whole lot of people dictate where you locate outlets and so on.

I'm thinking especially about layouts that have aisles along walls. Walls are such convenient places to put outlets. Often times it doesn't make a bit of difference to the whole layout where the aisles are located. The same goes for taking advantage of columns and railings. You can save a pretty penny on your electrical costs on moves by just a little rearrangement of desks here and there.

At least you will know how much it will cost you in advance for these special plans, and if there is a cheaper way of doing it. After the layout is frozen, you will only know how much that particular way of arranging will cost. The difference between the two may surprise you.

UNMATCHED TESTING FACILITIES...

one of many reasons for Hyatt leadership!

In testing laboratory or manufacturing plant, Hyatt's facilities are second to none. Continuing research in methods and materials, and exacting inspection with the finest in modern equipment, has made the Hyatt name a synonym for "highest quality." That's why Hyatt Roller Bearings are so widely used in design applications involving radial loads. Design engineers know that Hyatt bearings have been "performance-proved" for smoother, trouble-free operation and longer life. Hyatt Bearings Division, General Motors Corporation, Harrison, New Jersey.

HYATT ROLLER BEARINGS

MAINTENANCE POINTERS

FOR PLANT OPERATING EXECUTIVES

By CARL G. WYER • Maintenance Editor

Safety of worker, and better efficiency, results from . . .

. . . Use of 2-Way Telephone in Cleaning Underground Tanks

Cleaning fuel storage tanks at Tinker Air Force Base, Oklahoma City, is serious business.

Recently the Base equipped its tank cleaners with two-way "Maskfone" telephones (Mine Safety Appliances Company, Pittsburgh). This apparatus can be adapted to canister, tank-type, oxygen-generating, or extension-hose masks. Through a special speaking diaphragm the wearer can be heard nearby as well as at the other end of the line.

The phone fills a big gap—loss of contact with the worker. Now a man in the tank can holler if he needs more air. He can also report unusual conditions, get instructions, and have tools and equipment sent down as needed.

New Developments in Upright Sprinklers

This is the title of a pamphlet recently issued by the National Fire Protection Association. It is a report on a new design of an automatic sprinkler that uses less water.

The author, Norman J. Thompson, director of the Factory Mutual Laboratories, views the new design as being particularly useful as "a replacement for the present standard approved sprinkler in locations where the fire hazard approaches the limit of ordinary sprinkler capacity, or where water supply is somewhat scant."

"Superior protection," says Thompson in this report, "will be obtained with a given water supply with the same number of sprinklers operating. Equal protection can be obtained with a greater number of sprinklers in operation, even at substantially reduced flowing pressure. Such a substitution can be accomplished at a lower cost than any other available method for improving an existing sprinkler system."

"New sprinkler installations," he goes on, "can be made at considerably reduced cost if the new spray sprinklers in ordinary orifice size are spaced farther apart, allowing greater protected area per sprinkler, such as 25% to 33%."

The new sprinkler has other advantages. For instance, probability of stopping a slowly spreading fire with fewer sprinklers opened than with the standard type, hence less water damage. Also, the discharge of water onto a fire beneath a plugged sprinkler because of range of adjacent sprinklers.

Interested? You can get the 18-page report for 50¢ from National Fire Protection Association, 60 Batterymarch Street, Boston 10.

How Efficient Are My Air Filters?

If this is one of your problems, you may be interested in the "Dill Dust-Spot Tester." It's a 20-lb. portable machine that uses photo-electric principles to measure air filter efficiencies.

This apparatus is made by Trion, Inc., McKees Rocks, Pa. Its design is based on reliable methods suggested almost 15 years ago by R. S. Dill, chief of heating and air conditioning section of the National Bureau of Standards.

The apparatus is accurate within a range from 10% to 95% efficiency. It works for any type filter, anywhere, and with reasonably quick answers.

People who don't need continuing checkups of air contamination can rent the tester.

Turn to page 250 for good ways to solve special plant engineering problems

You can blame us for OBSOLESCENCE

Obsolescence is more than a matter of age—it's often Man-made. The fork trucks you bought from us 10 years ago were the best money could buy—THEN. But today they're obsolete.

And frankly, *we're* responsible for it. Obsolescence is the result of what we've been doing the past 10 years: constantly working on ways to improve those trucks. Our older models never saw the day when they could come close to what we're building now. These new CLARK trucks are designed to do more work—and do it faster, better and at lower cost. They're built to last longer. And with the multi-job attachments we've developed for them, they not only do more work, they do more *kinds* of work. Today's truck is amazingly adaptable and extra-useful.

Here's a complete line of modern trucks—gas, electric and diesel powered—that will outproduce your old equipment. You bought your original truck because you wanted to cut costs and increase efficiency. Now, competitive cost is more important than ever. And now is the time to replace the old equipment.

Your local CLARK dealer can give you the prescription for curing obsolescence --the specific reasons why *new* CLARK trucks are an investment in money-saving. Yes, you can blame us for obsolescence. But when you see what our new equipment will do for you, we're pretty sure you'll thank us for it.

1903 1953 FIFTY YEARS CLARK EQUIPMENT

CLARK ELECTRIC AND GAS POWERED FORK TRUCKS

AND POWERED HAND TRUCKS • INDUSTRIAL TOWING TRACTORS

INDUSTRIAL TRUCK DIVISION • CLARK EQUIPMENT COMPANY • BATTLE CREEK 1-8, MICHIGAN

Please send: ☐ Movie Digest ☐ Material Handling News ☐ Have Representative Call.

Name_____

Firm Name_____

Street_____

City_____ Zone_____ State_____

AUTHORIZED CLARK INDUSTRIAL TRUCK PARTS AND SERVICE STATIONS IN STRATEGIC LOCATIONS

SHOPMOBILE WITH STABILIZING JACKS DOWN PROVIDES FACILITIES EQUALING THOSE IN MAINTENANCE SHOP.

Mobile Workshop Rolls to the Job...

. . . with everything your maintenance men need —from ladder to locknuts.

Lucky the maintenance man whose company buys him a Shopmobile. *He'll* never have to foot it back to the shop for tools and equipment, parts and supplies. This new mobile workshop has everything he needs.

Shopmobile is all-steel welded construction, rolls on 6.00x16 4-ply tires. Comes equipped with rear stabilizing jacks, locking hand brake, a retractable-type front wheel. Has a towing ring for moves by tractor—and a tubular steel handle for manual pulling on short hauls.

Cost, in prime finish, $625 FOB Cleveland. With extras—ladder, ladder rack, pipe and machinist vises—about $800.

Stahl Metal Products, Inc., 3490 W. 140th St., Cleveland 11.

TRACTOR hooks on to make the long hauls, but Shopmobile has

LADDER EXTENDS to 24 feet for overhead maintenance work.

a front handle and retractable caster for shorter moves by hand.

WHAT'S NEW IN EQUIPMENT

. . . BRIEFED HERE FOR THE CONVENIENCE OF PLANT OPERATING MEN IS INDUSTRIAL PLANT EQUIPMENT NOW ON THE MARKET . . .

AUXILIARY EQUIPMENT 170
ELECTRICAL EQUIPMENT 180
MAINTENANCE TOOLS & SUPPLIES . 162
MATERIALS HANDLING 186
MEASURING & CONTROL 194
PAINTS 204
SAFETY & PLANT PROTECTION 206
VALVES & PIPING 212
MISCELLANEOUS 216

IN THE NEXT ISSUE . . . Some notes on important late items. More about them next month.

New maintenance machine designed not only for sweeping but also with a blower and suction system. Changeover in operations can be accomplished without stopping machine.
Wilshire Power Sweeper Co., Glendale, Calif.

Bantam low boiler-hp.-rated generators that can be employed individually or in tandem are on the market. The "Hotshot Tandem" ranges in B.H.P. from 1.8 to 3.6 each.
Automatic Steam Products Corp., 140 W. 31st St., New York 1.

Double-ended stackbins in racks will help reduce materials handling costs by servicing operators on two assembly lines set up face to face. Loading possible from either end.
Stackbin Corp., 1129 Main St., Pawtucket, R.I.

Static discharge reel with external adjustable tension lock permits increasing or decreasing tension of the wind-up spring.
Ericson Manufacturing Co., 5209 Euclid Ave., Cleveland 3.

send for your copy of this

new Snap-on* INDUSTRIAL CATALOG

In this comprehensive catalog is the complete line of Snap-on sockets and wrenches for industrial production. To users of power driven nut runners and impact wrenches, this book offers an instant answer to every socket need . . . every type, every size. Included is a wide range of Snap-on hand tools for assembly operations and plant maintenance. This *edition obsoletes any previous issue* that may be in your files. Write for your copy today.

SNAP-ON TOOLS CORPORATION

8044-C 28th Avenue, Kenosha, Wis.

* Snap-on is the trademark of Snap-on Tools Corporation

Begins on page 162

MAINTENANCE TOOLS & SUPPLIES

Versatile Centering Head

Maintenance men can use this handy pocket-sized device as a protractor, centering head, center punch, level, and scale.

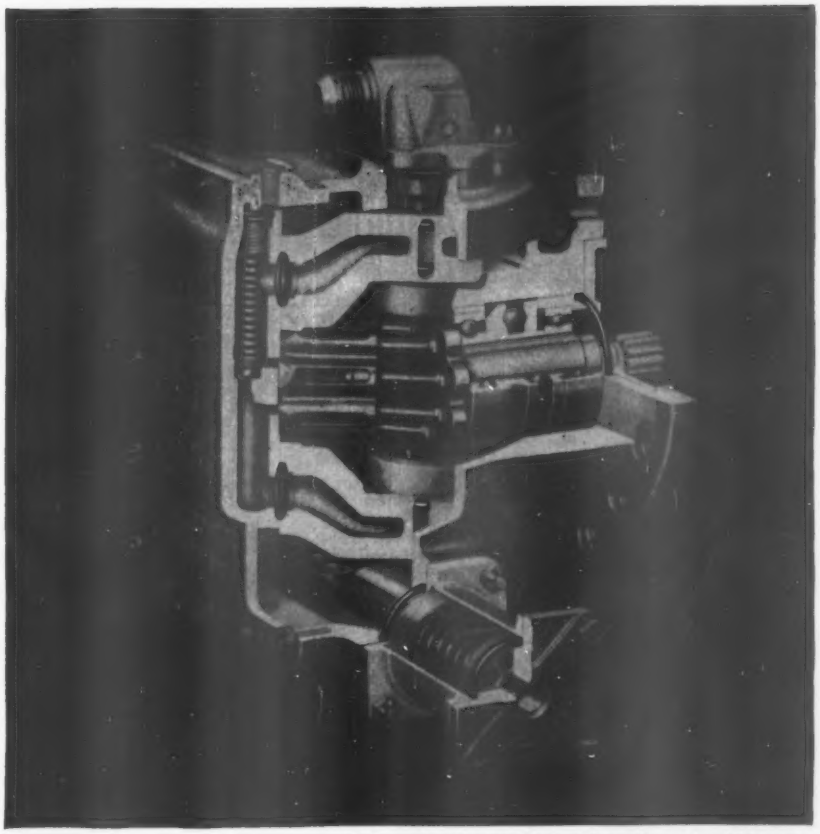
It will measure or establish any angle or bend on the outside or inside of any circumference. It will measure the degree of declivity of any flat surface. And it will mark a point at any degree from center on pipe.

Contour Marker Corp., 1843 E. Compton Blvd., Compton, Calif.

■

GUN-TYPE SOLDERING IRON that heats instantly and has a lightweight plastic handle is in production at the Wall Manufacturing Co., Grove City, Pa. The gun has heat-control thermostatic action to prevent gun from getting too hot or too cool.

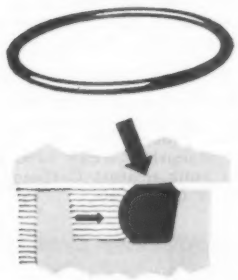
Turn the page



Cutaway view showing O-rings. Illustration courtesy Vickers, Inc.

PARKER O-RINGS help pumps set endurance record

THIS IS IT



Cross section drawing of O-ring in groove, sealing under pressure.

Vickers reversible flow 3,000 PSI hydraulic pumps, equipped with PARKER O-rings, recently operated 304,578 pump hours without malfunction for a 12-month period at one airline.

This noteworthy performance—in all sorts of weather—demonstrates the leakproof, long service qualities of PARKER O-rings . . . precision-molded from superior synthetic rubber compounds. Important, too, they provide simplified as well as efficient sealing. Design involves only a small groove to retain the ring. They are economical to use, easy to replace.

PARKER is the one source for *all* standard O-rings for fuel, hydraulic and engine oil services, and for special service O-rings. Ask your PARKER Distributor for Catalog 5100, or write The PARKER Appliance Company, 17325 Euclid Avenue, Cleveland 12, Ohio.

Parker

TUBE FITTINGS • VALVES • O-RINGS

Plants in Cleveland • Los Angeles • Eaton, Ohio • Berea, Ky.

Parker

O-RINGS

ARE STOCKED BY THESE AUTHORIZED DISTRIBUTORS

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Irving B. Moore Corp.
85 High Street, Boston, Mass.

BUFFALO, N. Y.
Hercules Gasket & Rubber Co.
327 Washington St., Buffalo 3, N. Y.

CHICAGO, Ill.
Air Associates, Inc.
5315 W. 63rd St., Chicago 38, Ill.
Shields Rubber Co.
108 N. Clinton St., Chicago 6, Ill.

CLEVELAND, O.
Cleveland Ball Bearing Co.
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Neff-Perkins Co.
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DENVER, Colo.
Metal Goods Corp.
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Los Angeles 22, Calif.

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Minneapolis 5, Minn.

NEW YORK, N. Y.
Durham Aircraft Service, Inc.
56-15 Northern Blvd., Woodside, N. Y.
Nielsen Hydraulic Equipment, Inc.
298 Lafayette St., New York 12, N. Y.

PHILADELPHIA, Pa.
Goodyear Supply Co.
1506 Latimer St., Philadelphia, Pa.

PORTLAND, Ore.
Hydraulic Power Equipment Co.
2316 N. W. Savier St., Portland 10, Ore.

ST. LOUIS, Mo.
Metal Goods Corp.
5239 Brown Ave., St. Louis 15, Mo.

TULSA, Okla.
Metal Goods Corp.
302 North Boston, Tulsa 3, Okla.

WICHITA, Kan.
Standard Products, Inc.
650 E. Gilbert, Wichita 11, Kan.

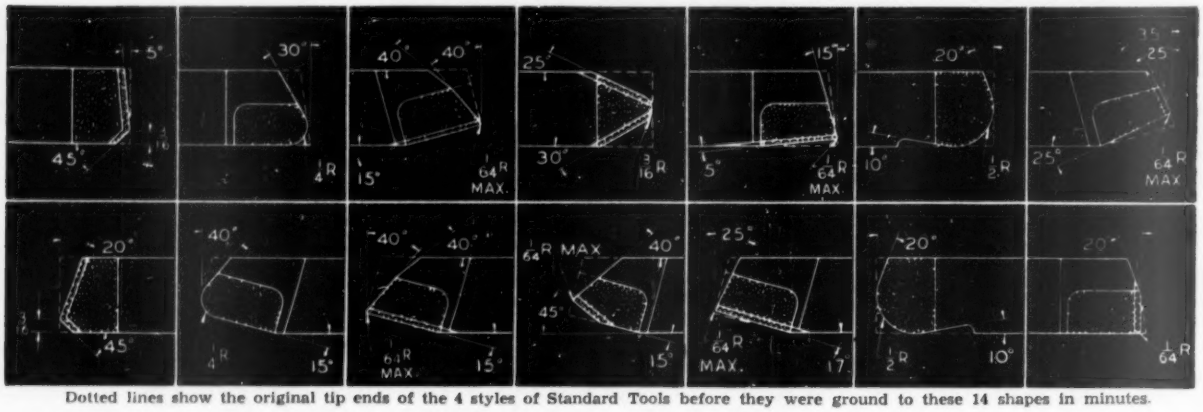
CANADA
Railway & Power Engineering Corp., Ltd.

YOUR CARBOLOY FIELD ENGINEER SAYS—

We can help you convert easily to Carboloy "Standard" Tools and get swift tool-ups, low inventories, lowest tool cost

HERE'S HOW one leading manufacturer quickly adapts low-cost Standard Carboloy Tools to his single-point tool machining operations – jobs that would normally require costly "specials" – and gets them on the jobs *in minutes*. No special grinding equipment. No delays or heavy inventories. By standardizing on "Standards," he gets full carbide benefits shopwide – just as you can. Check this page. Then have the blueprints of your tough single-point jobs sent to us. We'll show you how easily "Standards" can be best for you, too.

1 Gets 14 "specials" from these 4 styles of "Standards" – A large Midwestern manufacturer (name on request) needed 14 specially shaped tools for a rush job on cast steel gear blanks – a job 26" in diameter, 28" wide, and requiring many rough and finish turning, facing and boring operations. From their stocks they selected the 4 Standard Carboloy Tool styles shown . . . ground them to the shapes needed in minutes per tool. No long waits for costly "specials," no extra expense or production delays.



Dotted lines show the original tip ends of the 4 styles of Standard Tools before they were ground to these 14 shapes in minutes.

2 Easy for you to use, also – Adapting Standard Carboloy Tools to your special-tool needs is a cinch. They can be rough-ground quickly on ordinary silicon carbide wheels, finished economically on diamond wheels. Standard Carboloy Tools stay sharp up to 10 times as long as high-speed tools, last 10 times longer, too.

3 You get quicker tool-ups – You'll cut tooling delays to minutes instead of days or weeks, with "Standards" on your shelves. Your inventories will be lower – costs, too. Just 11 styles of Standard Carboloy Tools can be adapted to do up to 80% of all your single-point machining jobs.

4 You enjoy plantwide benefits – Let us help you convert to standard styles of Carboloy Tools – for plantwide benefits. Thousands of shops have done so . . . and now benefit from such things as production gains of up to 300%, downtime savings that more than pay for the cost of the tools.

5 Send blueprints of your "specials" – Let us review your single-point tool machining jobs that now require costly special tools . . . show you exactly what "Standards" can be adapted, and how. Send blueprints today to the factory at Detroit, or to your nearest Carboloy district office. No charge or obligation.

CARBOLOY
DEPARTMENT OF GENERAL ELECTRIC COMPANY
11135 E. 8 Mile Road, Detroit 32, Michigan

"Carboloy" is the trademark for the products of Carboloy Department of General Electric Company

The use of Carboloy Cemented Carbides for cutting tools is just one of the countless ways that Carboloy created-metals benefit industry. Look to Carboloy metallurgists to bring you even broader fields of use for present and future Carboloy created-metals.

CARBOLOY CREATED-METALS

ALNICO PERMANENT MAGNETS for lasting magnetic energy
CEMENTED TUNGSTEN CARBIDES for phenomenal cutting, forming, and wear resistance
CEMENTED CHROME CARBIDE for exceptional resistance to corrosion, along with abrasion and erosion resistance
HEVIMET for maximum weight in minimum space, and for radioactive screening

To get maximum performance from Standard Carboloy Tools, we have the industry's best all around Carbide Service Program. Includes all types of free how-to-do-it technical data, a tuition-free training school, etc. For details, write today for your free copy of General Tool Catalog GT-250.

FIRST IN CREATED-METALS FOR BETTER PRODUCTS

NEW MAINTENANCE TOOLS & SUPPLIES

Begins on page 162

For Paint Mixing Without a Paddle

These new paint mixers are designed to save you time, paint, and money. Mixing is said to be three times faster than with the ordinary wooden paddle. You do a better job of mixing, get the most out of your paint. And with paint quickly and easily mixed, it doesn't get a chance to settle.

Two models are available, the "Industrial" and "Professional." The Industrial (above) fits 5-gal. pails and clamps securely to the head. Blades cover the entire pail bottom for complete agitation. A cradle dispenser is available for use with this model.

The Professional doesn't have cover or spout. Blades scrape the pail bottom, extending across the full diameter of the pail.

Marien Metal Products Co., 1220 E. Nine Mile Rd., Hazel Park, Mich.

■

PAK-FONE, a completely self-powered portable 2-way radio for industrial use, is a new product of the Industrial Radio Corp., 428 N. Parkside Ave., Chicago 44. The set consists of an 8-tube transmitter and a sensitive 15-tube receiver.

Turn the page

Railroad highway bridge surfaced with Hexteel. Long service has proved its dependability and economy.

HEXTEEL®

Klemp Heavy-Duty SURFACE ARMOR

CUTS BRIDGE MAINTENANCE COSTS 3 WAYS:

1 *Absorbs damaging vibration* of traffic *over* bridge; of trains *under* bridge.

2 *Offsets harmful contraction and expansion* caused by heat and cold.

3 *Holds asphalt, concrete, other road materials firmly in place*—eliminates cracking, rutting, swelling, buckling, warping, shrinking.

Klemp HEXTEEL can be installed on wooden, concrete, even on brick-surfaced bridges. When embedded, it gives you a *steel-reinforced* surface that bears the brunt of heaviest traffic, severest vibration and weather—*with no need for maintenance.* Easy to install—available in a variety of gauges and depths.

GET THE FACTS— *judge for yourself*

Let the specialized Klemp engineer know your problem, give you complete description, illustrations and specifications on HEXTEEL Surface Armor. He will cooperate with you fully. Write Klemp's Engineering Division today. No obligation!

KLEMP METAL GRATING CORPORATION
Executive Offices: 1371 North Branch Street
Chicago 22, Illinois
Plants and Warehouses at Chicago, Ill. and Houston, Texas

FREE! Hexteel Catalog—facts, specifications, installation instruction.

We Tread The World with Safety

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1371 North Branch Street, Chicago 22, Illinois
Please send me the Klemp Heavy-Duty HEXTEEL Surface Armor catalog.

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ASK YOUR DISTRIBUTOR FOR

CHESTER HOISTS

Chester Spur-Geared Chain Hoists, ¼ to 25 ton . . . and many special types including the Extended Handwheel and Low Headroom.

→ BECAUSE THEY'RE DURABLE

. . . from hook to hook. Chester Hoists are built for a steady job of lifting, and built to last with quality castings and forged parts, and with Timken Tapered Bearings for smoother operation and longer wear.

→ BECAUSE THEY'RE DEPENDABLE

. . . Chester Hoists are expertly designed and ruggedly constructed to deliver high mechanical efficiency in everyday lifting. They're actually built to a safety factor of 5 times the rated load, to protect your men and equipment.

→ BECAUSE THEY'RE ECONOMICAL

. . . ease of maintenance is an outstanding feature of Chester Hoists. With Timken instead of ordinary bearings, they can be much more readily torn down and reassembled . . . serviced on the spot in a matter of minutes with ordinary tools.

→ BECAUSE THEY'RE SPEED-SERVICED

. . . any Chester Hoist part can be quickly supplied as needed. When your hoist requires factory overhaul and testing, it will be done quickly and completely, and the hoist will be rushed right back to work for you.

Ask your distributor, or write us, for complete catalog, and tell us your requirements.

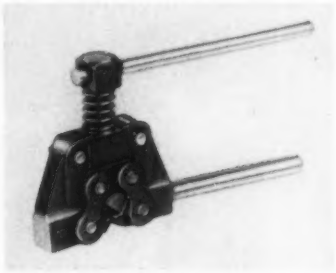
CHESTER HOIST DIVISION

The National Screw & Mfg. Company, Lisbon, Ohio

National Products — FASTENERS — HODELL CHAINS — CHESTER HOISTS

NEW MAINTENANCE TOOLS & SUPPLIES

Begins on page 162



Chain-Breaking Tool

When you want to disconnect roller chain in seconds, try this chain-breaking tool for size. Works on chains varying from ¼-in. to ¾-in. pitch—any make, any model.

Just insert the roller link of the chain to be disconnected between the jaws of the tool. Then turn an adjustable lever. This forces the pressing tip to push the pin through the pin link plate.

Boston Gear Works, 14 Hayward St., Quincy 71, Mass.

■

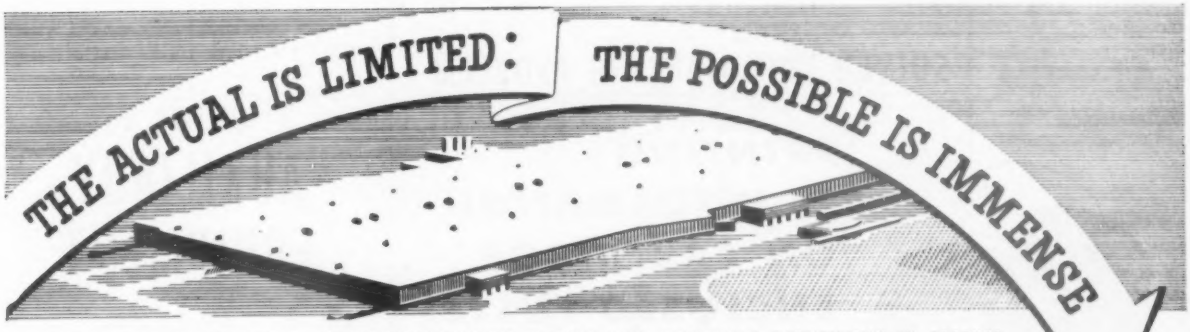
Impact Wrench For Fast Nut Running

You can handle up to ⅞-in. nuts and bolts with this electric impact wrench.

The 4EW Tork Hammer weighs 16¾ pounds, has a spindle speed of 1800 rpm. There is a pistol grip with detachable side handle and a built-in trigger switch with lock-ring pin. The heavy-duty reversible universal type a-c, d-c motor works on 115- or 230-volt current.

Mall Tool Co., 7725 S. Chicago Ave., Chicago 19.

Turn the page



NEW LINCOLN PLANT CREATED BY INCENTIVE-INSPIRED CO-ACTION IN DEVELOPING POSSIBILITIES IN PRODUCT

© LE Co. 1952

WELDED STEEL DESIGN CUTS MANUFACTURING COSTS

. . . saves machining, simplifies production

MANY types and sizes of machine components can be produced more efficiently . . . with less material . . . at less cost through welded steel design. From heavy equipment like large presses (Fig. 1 & 2) to small machines (Fig. 3 & 4), proper design in welded steel saves materials, saves labor . . . cuts cost.

Material costs are less with welded steel designs because fewer pounds of metal are required on which less machining and less finishing is necessary. Products have better selling appeal with welded steel's modern appearance.

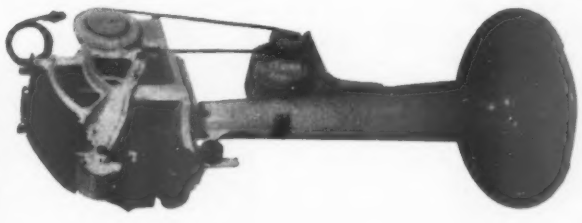


Fig. 4. Original Construction *of marking machine. Had high rejection rate in castings. Required considerable machining and finishing. Weighed 83 pounds.*

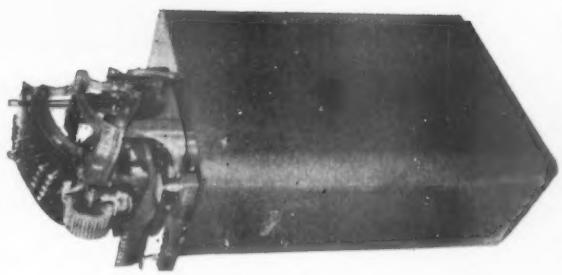


Fig. 3. Welded Design. *Cuts manufacturing cost 25%, weighs 33% less. Cabinet type base is now fabricated from 16 gauge metal and welded in simple fixture. Steel design eliminates entire cost of machining and handling originally required.* Courtesy National Marking Machine Company, Cincinnati, Ohio.

PROPER DESIGN IN WELDED STEEL IMPROVES PRODUCT AND LOWERS COST

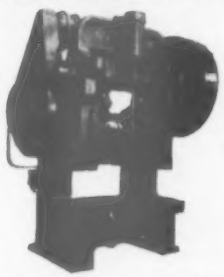


Fig. 1. Original Construction *of multiple punch press. Material cost was $.10 per pound from this manufacturer's own foundry. Weight was 56,000 pounds.*

INCREASES RIGIDITY SAVES MATERIAL

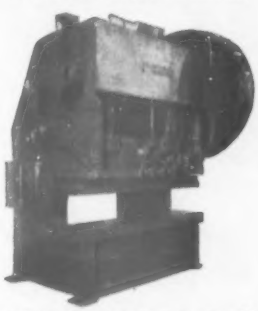


Fig. 2. Welded Steel Design *is actually more rigid than former casting yet weighs only 49,550 pounds. Modern in appearance . . . costs 15% less.* Courtesy Williams-White and Co., Moline, Illinois.

MORE PROOF

Machine Design Sheets available on request. Designers and Engineers write on your letterhead to Dept. 3701.

THE LINCOLN ELECTRIC COMPANY

Cleveland 17, Ohio

THE WORLD'S LARGEST MANUFACTURER OF ARC WELDING EQUIPMENT

MARKEM SOLVED THIS MARKING PROBLEM

PRINTING LABEL INFORMATION ON CARTRIDGE ENCLOSED FUSES

Working closely with Underwriters' Laboratories, Inc. and with leading fuse manufacturers, Markem has developed a method which makes possible for the first time the printing of label information directly on cartridge enclosed fuses at production rates. Markem's direct ink imprints cannot "fall off" and are unaffected by moisture or ordinary chemical atmospheres. Paper label inventory and wastage problems are eliminated. Print is larger and color coding and identification are simplified. Fuse manufacturers anticipate better labeling at higher production rates and with lower costs. The Markem Method —Markem Machine, Markem type and ink and the special recording die roll for use when UL Manifest is required—as well as the imprint itself meet with UL approval.

MARKEM® MARKS THEM ALL

CAN MARKEM HELP YOU? Printing labels directly on cartridge enclosed fuses is but an example of how Markem solves industry's marking problems. Markem has been providing industry with production techniques and equipment to identify, decorate or designate its products, parts and packages since 1911. Markem also provides technically trained men who are available in your area to assure *continued* satisfaction with Markem methods and equipment.

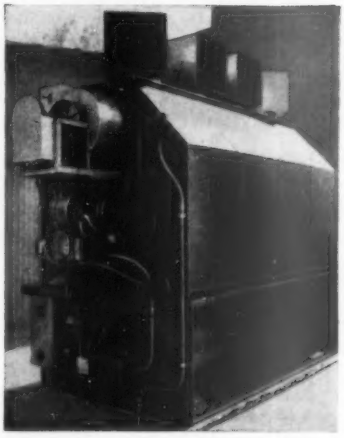
When *you* have a marking problem, tell us about it and send a sample of the item to be marked. Perhaps a complete Markem method has *already* been developed to solve your problem. If not, Markem will work out a practical solution.

Markem Machine Company, Keene 18, N. H., U.S.A.

MARKEM ...TO MAKE YOUR MARK

Begins on page 162

AUXILIARY EQUIPMENT



Automatic Heating System

You can get this self-contained, automatically operated heating system in 12 sizes—from 200,000 to 2-million Btu's.

Four-way heat discharge heads and floor-line return air grilles control the direction and extent of heated air circulation.

Model "H" is designed for light oil, heavy oil, gas, or combination gas-oil firing. The light and heavy oil-fired units are listed by Underwriters' Laboratories.

National Heater Co., 2182 Cleora Ave., St. Paul 4, Minn.

■

ALL-RAYON FABRIC RUBBER TRANSMISSION BELTS, according to the B. F. Goodrich Co., Akron, Ohio, are stronger, have greater flex life, and are more compact than similar cotton fabric belts. A 6-ply rayon fabric belt is only as thick as a 4-ply cotton fabric belt. You can use "Drivesall" belts on medium-duty drives for fans, blowers, air compressors, and other plant equipment.

Turn the page

NOW there is a way to get THE FACTS —get them fast, direct, on the record— and THIS IS I.T.*

***Industrial Televoice,** EDISON's new floor-to-management communications system . . . Here, at last, is a "fact conveyor" that works—because it's easy. It's easy for the man on the production floor: he doesn't write anything —he just talks. And it's equally easy on the man at the management control point: he doesn't have to listen to the talk—he reads it!

A network of TELEVOICE phones is installed wherever vital information originates—and connected to central recording equipment in the appropriate department. Reports and requests are "phoned" in from the floor and recorded on plastic discs. At frequent intervals, the recorded information is transferred to your forms and distributed for action, control or analysis. That's all there is to it!

New as it is, INDUSTRIAL TELEVOICE has already proved its value in controlling and coordinating production, inspection, maintenance and shipping and receiving. But the whole story has yet to be written. In your plant, you'll probably discover additional applications we haven't even dreamed of.

Once you see INDUSTRIAL TELEVOICE in action, you'll recognize it as the *communication* system that makes *operating* systems work.

Industrial EDISON TELEVOICE

Ask for trial demonstration!

We'll be glad to arrange a trial demonstration of EDISON INDUSTRIAL TELEVOICE in your plant. Just send the coupon —or contact your nearest EDISON VOICEWRITER representative (see classified directory).

Thomas A Edison INCORPORATED

EDISON *(Ediphone Division)*, 40 Lakeside Ave., W. Orange, N. J.

Yes, EDISON, I want information on a trial demonstration of INDUSTRIAL TELEVOICE.

Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____

Fingertip heat control

right at the work-with the

P&H Welding Twins

equipped with Dial-lectric Control

Dial-lectric Control is an exclusive P&H feature that helps you weld faster, easier, better — at less cost!

P&H AC WELDER

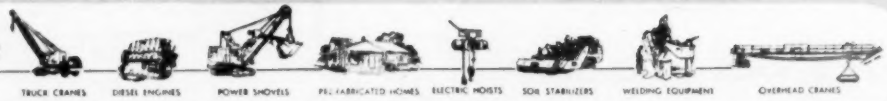
As easy as tuning your radio — just turn the radio-type knob of the Dial-lectric Instantaneous Remote Control (or step on a foot treadle), to adjust heat accurately. Easy, quick-start arc. No hard-working cranks to turn. No moving parts to cause delays or maintenance expense. Sizes up to 625 amps., NEMA rated. Connectable to 220 and 440 volts.

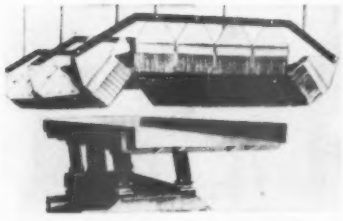
P&H DC RECTIFIER WELDER

Also equipped with hand-or foot-operated Dial-lectric Control, to give the welder fingertip heat control at the work. No hard-working cranks to turn. No moving parts to wear out. Saves on power costs under load — and during idle and no-load periods. Protects the primary input line against unbalanced conditions. Three sizes, 200, 300, and 500 amps., NEMA rated.

P&H WELDING DIVISION
HARNISCHFEGER CORPORATION
4525 WEST NATIONAL AVENUE • MILWAUKEE 46, WISCONSIN

the P&H *Line*





Infra-Red Heating Panels

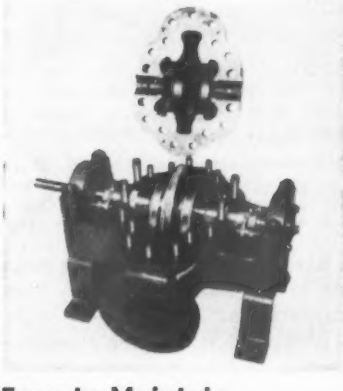
You can now obtain a uniform, direct-radiating pattern without the use of reflectors, thus lowering production costs and time for all baking, drying, and heating processes.

The infra-red heating panels consist of 2 to 8 elements backed by thermal insulation. The panels are attached on a steel box-type frame.

Mounting flanges on frame make it possible to arrange the panels in the form of ovens, dryers, and heaters for operation on commercial a-c or d-c frequency.

Syntron Co., 480 Lexington Ave., Homer City, Pa.

■



Easy-to-Maintain Centrifugal Pumps

Ease of maintenance is standout feature in this new series of single-stage, double-suction centrifugal pumps. The Fig. 3405 line has capacities ranging from 200 gpm. to 6400 gpm., with heads up to 260 feet.

You can remove the upper half of the pump casing for inspection and maintenance. The entire rotating element comes out without disturbing the suction and discharge piping or the pump and driver alignment.

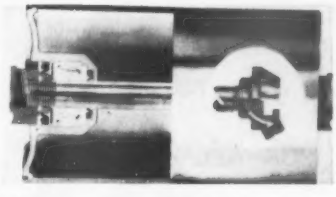
You can change direction of impeller rotation without additional parts.

You can change motors in the field without drilling and tapping for your new motor.

Impeller is cast in one piece of iron or bronze. All exterior surfaces are machined. All interior surfaces of waterways are hand-finished.

Goulds Pumps, Inc., Seneca Falls, N. Y.

■



Conveyor Idler Has Built-In Lube

Operate the Type "UST" belt conveyor idler one, two, even three years without lubrication, depending on the conditions. It won't hurt the bearings a bit, the maker claims.

The pre-lubricated idler bearing has a factory-sealed grease reservoir. It's said to prevent grease from getting out and dirt and moisture from getting in.

When the seals and lubricant need replacement, the entire unit can be disassembled, re-lubricated, and sealed again for similar long periods of maintenance-free service.

Industrial Division, Continental Gin Co., Birmingham 2, Ala.

■

SPACER-TYPE GEAR COUPLING introduced by Sier-Bath Gear and Pump Co., 9252 Hudson Blvd., N. Bergen, N. J., can be disconnected in a matter of seconds without special tools. Makes it possible to remove hubs from either shaft without disturbing mountings of the connected units.

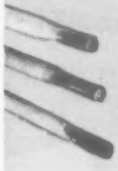
Turn the page

P&H

Welding Equipment

speeds production schedules, cuts costs

P&H LOW-HYDROGEN ELECTRODES



13 types for high-strength welds on problem steels, steel castings, nickel-alloy steels, chrome-moly steels, .40 carbon castings, high-hardenable steels, aircraft and similar steels.

P&H POSITIONERS

Position heavy weldments for economical downhand welding. Complete range of sizes to handle work from 2500 to 36,000 lbs. — remote-control and hand-operated models.

P&H WN-301 *Engine-Driven* DC ARC WELDER

2- or 4-Wheel Mountings

Portable. Equipped with Dial-electric Control, for fingertip heat control at the work — gives you faster, better welding. Runs at only 1750 rpm. Welding service range, 60-375 amps, NEMA rated.

Ask your P&H representative or distributor for complete information, or write for free bulletins.

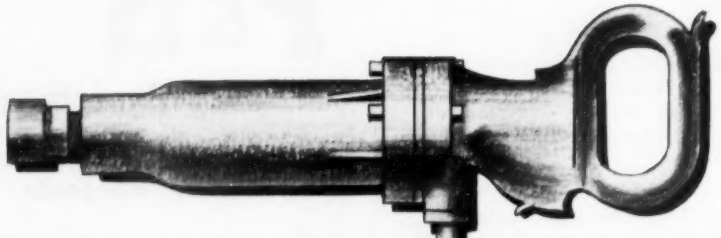
P&H WELDING DIVISION

HARNISCHFEGER CORPORATION

4525 W. National Ave., Milwaukee 46, Wis.

2494A

HOW MUCH DOES IT COST YOU...



WHEN A PNEUMATIC TOOL FAILS?

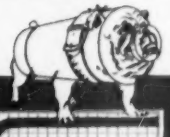
One failure of a pneumatic tool costs more than a line type Hi-eF Purifier! These low-cost units installed *immediately* ahead of the air tool keep out of the air line all dirt particles and moisture that materially shorten the life of pneumatic equipment—corroding and wearing out vital parts.

These amazing, low-cost units pay you a rich profit by adding months to the life of your air equipment. Installed in a matter of minutes, they have no moving parts—nothing to wear out, nothing to clog up. See your distributor today. Try one ahead of your most troublesome air tool. Mail coupon for literature and prices.

THE V. D. ANDERSON COMPANY
1997 West 96th Street • Cleveland 2, Ohio

It costs only $13.20 for this Hi-eF Purifier on a 3/4" line.

WATCHDOG *OF STEAM • AIR • GAS • VAPOR PIPELINES AND EQUIPMENT*



ANDERSON **Hi-eF** PURIFIERS

THE V. D. ANDERSON COMPANY
1997 West 96th Street • Cleveland 2, Ohio

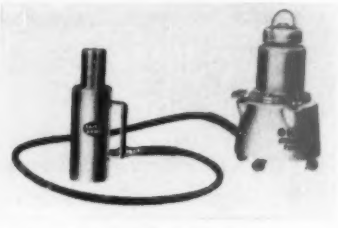
Please send literature and prices on small line type purifiers.

Name ..... Title .....
Company .....
Address .....
City ..... State .....

BY THE MAKERS OF SUPER-SILVERTOP STEAM TRAPS

NEW AUXILIARY EQUIPMENT

Begins on page 170



For Heavy Lifting: Hydraulic Pump, Ram

This air-powered hydraulic pump-ram combination will help cut down on manpower for the heavy jobs.

The pump provides smooth hydraulic pressure from 0 to 12,000 psi., needs only a simple airline connection. It can be adapted to any hydraulic installation and to manually-operated arbor presses. Since it weighs only 35 pounds, you can carry it to the job. Or you can roll it right up to the job on casters.

The ram unloads itself automatically at all times, even when fully extended. This means there's no chance of plunger pop-out. Rams are available in 20-, and 70-ton capacities. They can be used with any type or make of hydraulic pump.

Powermatic, Inc., 1944 E. Market St., Akron 5, Ohio.

■

A NEW MULTIPLE V-BELT-DRIVE PUMP for the handling of heavy fuel oils and for other noncorrosive viscous liquids has been marketed by the Tuthill Pump Co., 939 E. 95th St., Chicago 19. The unit features wide flexibility along with other structural and performance advantages.

■

A NEW INKLESS SPEED RECORDER has been announced by Metron Instrument Co., 432 Lincoln St., Denver 9. It is available in 18 different speed ranges. Maker says it can easily be installed semiflush in a control panel.

Turn the page

are your CUTTING COSTS really down far enough ?

No. 3½ FRICTION SAW
HYDRAULIC FEED

you'll never know for certain until you COMPARE your PRESENT cutting speed with

the faster Kling *HIGH SPEED* FRICTION SAW!

What is friction sawing?

It's a proven method of cutting metal by generating heat through friction on the part to be cut at a rate faster than that part can absorb heat. This temperature increase reduces the tensile strength of the piece to the point that the weakened surface can no longer resist the action of the colder blade. The metal is thus easily removed with no apparent wear on the blade surface.

Fastest, all-around cut-off machine in the shop!

Cuts all types of steel, hard or soft, big or small, in any shape, without distortion. For day-in, day-out production, one Kling Friction Saw will do the volume of work that would ordinarily require several separate shears or slow speed saws. One of the big time-saving reasons is the ability of the Kling Friction Saw to cut any structural shape, without change of blade or setup. Because the average Friction Saw blade will give a good full day's production before requiring redressing, you eliminate costly downtime and also save on tool costs.

FREE complete, friction sawing information!

Learn how you can profitably apply Kling Friction Sawing in your plant. The information contained in this 12-page bulletin will give you the complete story on Friction Sawing . . . including the principles of the process and some of its applications. Write today for your FREE copy.

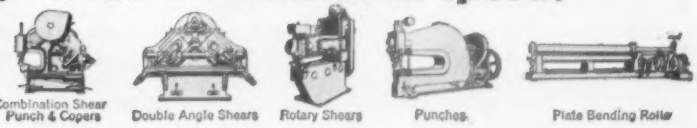
KLING BROS. ENGINEERING WORKS
Dept. FM, 1325 N. Kostner Ave. • Chicago 51, Ill.

How long would it take you to cut these pieces?		With a Kling friction saw you could do it in approximately...
24" 100 lb. I Beam	⊢⊣	28 seconds
15" 55 lb. Channel	⊏	15 seconds
8"x8"x34.3 lb. H Beam	H	10 seconds
100 lb. A.R.A. Rail	I	9 seconds
6-1/2"x6-1/2"x19.8 lb. Tee	T	5 seconds
8"x8"x3/4" Angle	∧	11 seconds
3" Square	■	10 seconds
4" Round	●	15 seconds
6" O.D. Tube, 1/2" Wall	○	11 seconds

6008R

*What's your requirement? There's a size to fit your specific needs—large or small.

Since 1892 **Kling** ***...an investment in speed!***



Combination Shear Punch & Copers | Double Angle Shears | Rotary Shears | Punches | Plate Bending Rolls

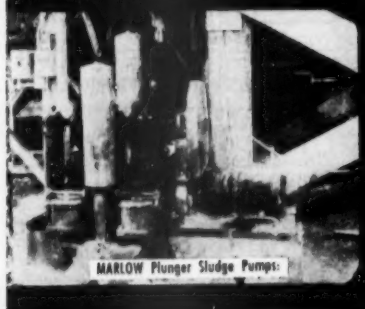
ACTION

proves

MARLOW PUMPS

MARLOW Self-Priming Centrifugals:

MARLOW Diaphragm Pumps:


MARLOW Plunger Sludge Pumps:

MARLOW Horizontal, End Suction, Centrifugal Pumps:

are the* BEST

. . . for dependable, low-cost performance throughout industry!

Marlow Industrial Pumps are recognized as standard equipment for handling today's complex pumping problems. The Marlow industrial line is complete. Each pump is specifically designed for a particular function . . . they are job-engineered to meet specifications.

Marlows are recommended for efficiency and endorsed by industry for constant low-cost performance.

Modern Pumps for Modern Industry

MARLOW Self-Priming Centrifugals:
Automatic priming on suction lifts. Designed to handle a wide range of liquids with viscosities up to 500 S. S. U. Will not vapor lock. Close or long coupled, sizes 1½" to 10", 15 to 3,500 GPM, heads from 15 to 170 feet. Motors ¼ to 60 HP. Available for belt and gasoline engine drive.

MARLOW Diaphragm Pumps:
Built to take over the toughest kind of industrial pumping . . . for moving heavy, sluggish wastes. Gasoline, electric, or belt driven. Sizes 2, 3, and 4 inch single and 4 inch double. Capacities from 20 to 150 GPM.

MARLOW Plunger Sludge Pumps:
Rugged construction for long, hard use around-the-clock on the heaviest pumping assignments. Electric motor driven, operated with V-belt or roller chain drive. Sizes 4 to 8 inches. Capacities to 500 GPM. Special high-pressure models available.

MARLOW Horizontal, End Suction, Centrifugal Pumps:
Compact design for high-efficiency pumping of light liquids on flooded suctions. Close or long-coupled, sizes – 1" to 8". Capacity, 10 to 2,000 G.P.M. Motors ½ to 60 HP.

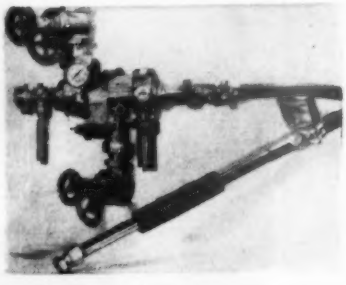
For more than a quarter of a century Marlow has been manufacturing pumps exclusively. When we say "Marlow means performance plus" it is based on facts and records.

Complete details available from your Marlow distributor 102

MARLOW PUMPS RIDGEWOOD, NEW JERSEY
Branch Plant: De Queen, Arkansas.
Other factories in France and England. Distributors and Dealers everywhere.

NEW AUXILIARY EQUIPMENT

Begins on page 170



Jet Cleaning for Low-Pressure Steam

You don't need high-pressure steam facilities to get the advantages of hydraulic jet cleaning, the Sellers people claim. With their Booster Jet you can convert your 5 to 25 psi. inlet steam pressure to 100- to 200-psi. discharge pressure for the tough cleaning jobs. Jet length is manually controlled, extends up to 30 feet from the discharge nozzle. It produces no injurious fumes, says the company.

Sellers Injector Corp., 1600 Hamilton St., Philadelphia 30.

■

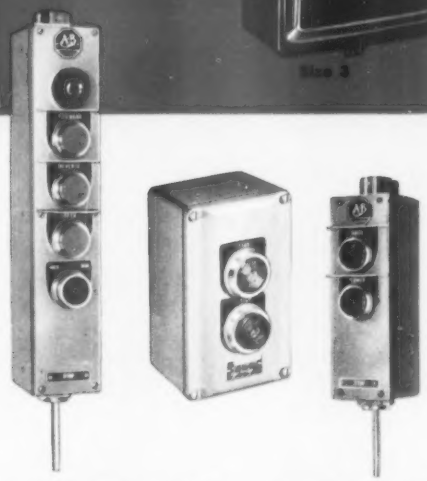
Stapling Tacker

Driving and clinching staples in hard-to-reach places where a blade cannot be inserted to clinch the staple is the specialty of this new fastening tool.

Stapler automatically drives staples and turns the legs outward to clinch under or inside the work. Can be employed effectively to fasten insulation around pipes and ducts.

Bostitch, 1007 Mechanic St., Westerly, R. I.

MOTOR STARTERS • 8 SIZES • ALL SOLENOID OPERATED



COMPLETE LINE OF OILTIGHT ACCESSORIES

Allen-Bradley oiltight push buttons and accessories are available for single and multiple controls in all forms, including pendent types for machine tool drives. Oiltight gaskets seal the switch mechanism against oil seepage around push buttons and covers.

There are pilot lights, selector switches, stop and start push buttons, limit switches, and many other varieties of controls in the standard Allen-Bradley line to meet every machine tool requirement.

Automatic Starters That Satisfy All Machine Tool Applications

Machine tool speeds are being steadily increased—machining operations are demanding greater and greater precision in motor control performance. These simple facts explain why Allen-Bradley solenoid motor controls . . . with only one moving part . . . are so popular with machine tool builders. In the complete line from Size 0 to Size 7, the same trouble free solenoid principle is used. There are no clapper switches . . . hence, no change in performance . . . no loss of compactness . . . no drop in dependability.

This basic design simplicity accounts for the supreme popularity of Allen-Bradley controls. The A-B trademark is a sales asset on any machine. May we send you our Handy Catalog?

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.

3-53-M

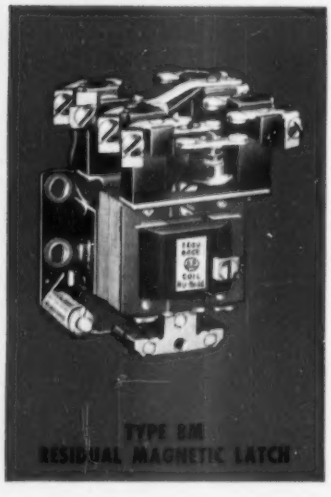
A-B Quality

ALLEN-BRADLEY

SOLENOID STARTERS

QUALITY

HUM-FREE A-C RELAYS

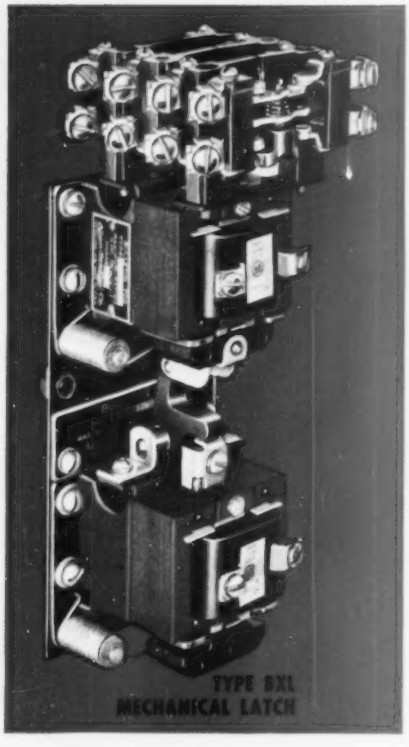


Here are two unique, hum-free relays that require no coil current to keep them closed.

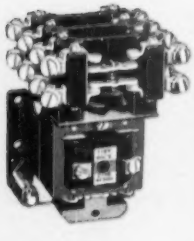
The Type BM relay is a compact unit which is closed by momentarily energizing the solenoid coil. The relay is held firmly closed by residual magnetism until opened by a momentary demagnetizing current.

The Type BXL relay is a standard Bulletin 700 magnetic relay with a mechanical latch. The secondary solenoid, beneath the relay, delatches the upper relay to open it.

Allen-Bradley Co.
1316 S. Second St., Milwaukee 4, Wis.

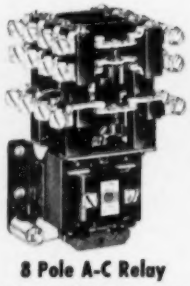


A-C and D-C TROUBLE FREE CONTACTORS and RELAYS
for Automatic and Sequence Controls



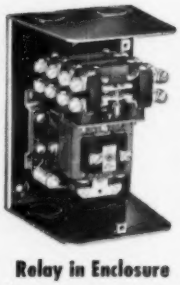
4 Pole A-C Relay

This universal type relay is equipped with four normally open contacts and four normally closed contacts, all actuated by one solenoid plunger. Great flexibility of circuit connections is offered by the double arrangement of contacts. Will handle circuits up to 600 volts a.c. Widely used in refrigeration and air conditioning. Contacts need no maintenance.



8 Pole A-C Relay

Bulletin 700 relays are listed in many contact combinations and polar arrangements. They are widely used for oil burners, stokers, unit heaters, and as control relays for electric furnaces. They are good for millions of trouble free operations. Their consistent performance makes them ideal for machine tool sequence operations. There is no contact maintenance.

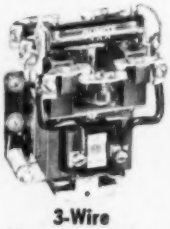


Relay in Enclosure

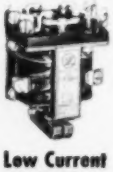
These relays can be furnished open or in enclosures that protect them in applications where watertight, weatherproof, or explosion-proof enclosures are needed.

Push buttons and limit switches available in a variety of enclosures.

Send for Allen-Bradley Bulletin 700 for details of relays with 1, 2, 3, 4, 5, 6, 8, and 10 poles.



3-Wire Thermostat Relay



Low Current A-C Relay

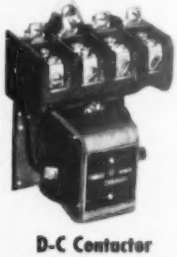
For temperature controls with thermostats.

D-C Relay

2 N.C. —1 N.O. contacts.

A-C Contactor

Allen-Bradley a-c contactors are available up to 900 amperes.



D-C Contactor

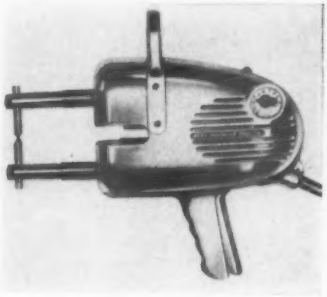
Allen-Bradley direct current contactors are available in single and double pole construction up to 600 amperes.

ALLEN-BRADLEY
RELAYS & CONTACTORS

3-53-M

NEW AUXILIARY EQUIPMENT

Begins on page 170



Time-Controlled Portable Spot Welder

The welding of most alloys of aluminum sheet as well as mild, stainless, galvanized, and cadmium-plated steel—plus other metals up to 3/16-in. over-all thickness—can be performed by this portable tool. The cycle controlled by a built-in thyratron can be varied between 1/60-second and 1 second.

The standard model has a 7-in. throat depth with a 3-in. opening. Special throat depths up to 18 inches and special arms and tips are available. Operating from 220 to 240 volts, 60-cycle a-c, the tool develops an electrode pressure to 1000 pounds and an amperage in excess of 12,000 at the point of weld.

Ross Machine Tool Co., 7631 S. Ashland Ave., Chicago 20.

■

FANS FOR COOLING TOWERS AND LARGE HEAT EXCHANGERS come in two basic sizes, with hub diameters of 48 and 72 inches. The Moore Co., Marceline, Mo., says you can get the Class 7000 Type C fans with 2 to 8 blades to adapt to your needs. Units can be had with standard diameters up to 24 feet. They're constructed of corrosion-resistant materials throughout. Resilient mounting of blades is designed to eliminate bending stresses. A single nut adjusts all blades simultaneously for a fast, uniform pitch change, maker says.

Turn the page

USE EITHER SIDE
In this position rolls are high in frame to permit handling of packages wider than conveyor.
In this position rolls are low in frame, and frame forms a guard rail, when it is desired.

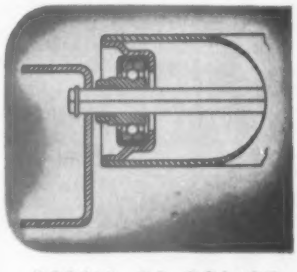
ONE of MANY practical features of *Logan*

STOCK ROLLER CONVEYOR

Shown above is one of the features of Logan Stock Roller Conveyor. Other features include (a) immediate shipment (b) available in several sizes (c) both straight and curved sections can be furnished (d) both stationary and portable supports available. Use the coupon for literature.

FEATURES

ROLLER—2¼" O.D. No. 16 Ga. Welded Steel Tubing. Pressed Steel cup secured to tubing. Cap. 150 lbs.
SHAFT—7/16" Hexagon Cold Rolled Steel. Positively locked against rotation by hexagon holes in frame.
BEARING—No. 50. Slip fit in cup, easily removed and replaced. Protected position—set back from end of roll.
FRAME—3½"x 1¼"x10 Ga. Pressed Steel Channel. With four 1-5/16" O.D. 13 Ga. Welded Tubing ties per 10'-0" section. Capacity 75 lbs. per foot with supports on 10'-0" centers and 380 lbs. per foot with supports on 5'-0" centers.
COUPLING—Furnished with bolted type for stationary service. Can furnish hook type for portable service if preferred.



DETAIL OF ROLLER

ALSO Stock WHEEL CONVEYORS
In both straight and curved sections. Ideal for portable use. Light-to-medium duty. Write for details.

Write or Phone Your Requirements

Logan CONVEYORS
LOGAN CO., 510 CABEL ST.
LOUISVILLE, KENTUCKY

Logan Co., Louisville, Ky.
☐ Send literature on Stock Conveyors
Mr._____
Firm_____
Address_____

Look through this piece of SOLID STEEL

...you'll see a new way to improve your product for strength and lightness plus free passage of heat, light and air!

Not woven, not welded, but pierced and s-t-r-e-t-c-h-e-d from a single sheet of solid steel, Wheeling ExM is ideal for grills and partitions, racks, bins and walkways, for a thousand-and-one uses—wherever you want the *strength of solid steel you can see through!* Write today for complete data!

It's Wheeling Expanded Metal!

Wheeling

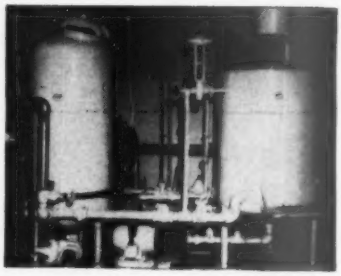
WHEELING CORRUGATING COMPANY

WHEELING, WEST VIRGINIA

Atlanta Boston Buffalo Chicago Columbus Detroit Kansas City
Louisville Minneapolis New Orleans New York Philadelphia Richmond St. Louis

NEW AUXILIARY EQUIPMENT

Begins on page 170



Tank-Type Pressure Filter

This new type of filter needs no cloths, papers, screens, or pads. It can be used in filtering oils, chemicals, or electroplating solutions; recovering wastes, and treating waste water.

The unit employs a series of synthetic, rigid, porous stone membranes upon which a filter-aid coating is deposited. Available in all capacities in metals and alloys, as well as plastic- and rubber-lined.

Ogden Filter Co., 4214 Santa Monica Blvd., Los Angeles.

■

New Flame Cutter

You can use this tool for reworking, reconditioning, and salvaging all types of new and used welding ells, tees, flanges, and reducers.

The flame cutter is mounted on a steel-base table that rotates in either direction, at speeds varying up to 5 rpm. It has a unitized control panel.

Vernon Tool Co., 1101 S. Meridian Ave., Alhambra, Calif.

■

HYDRAULIC HOSE COUPLING AND ADAPTER, when drawn up hand-tight, will not leak when subjected to pressures up to 5000 psi., says Eastman Mfg. Co., Manitowoc, Wis. Connecting and disconnecting coupling is quick and easy.

Turn the page

it's Your "Q"

Quality . . . that costs no more is yours when you choose Fairbanks-Morse Side Suction Centrifugal Pumps. Extensive engineering laboratories . . . production line methods with precision machining of all parts enable Fairbanks-Morse to offer you a side suction centrifugal with the design, workmanship and performance normally obtained only in highest quality split-case pumps.

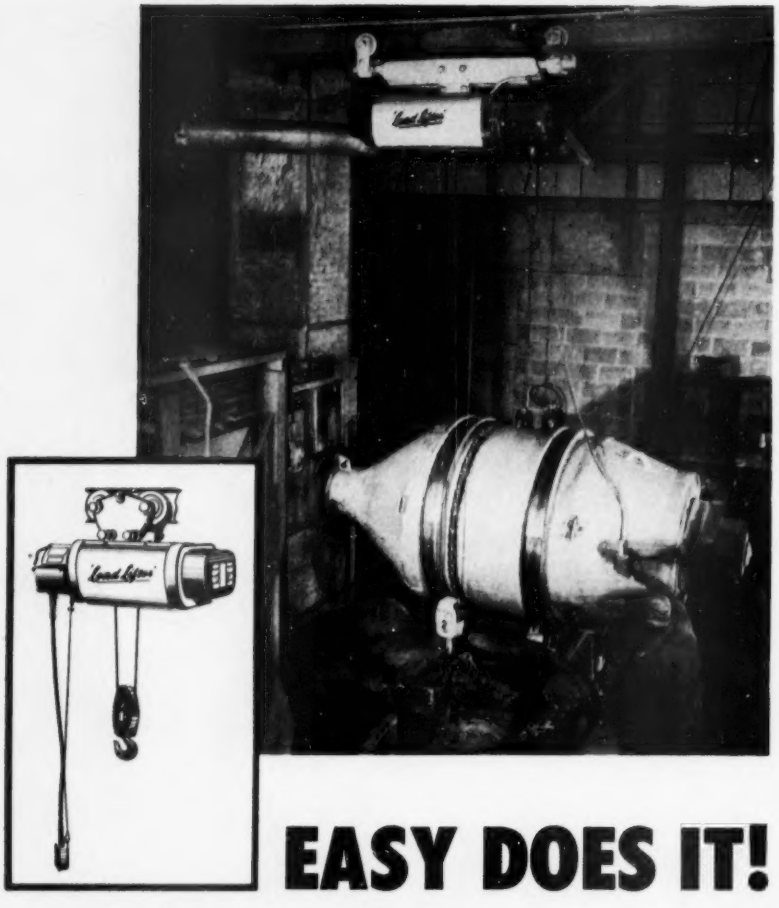
Open type, single suction, high efficiency impeller . . . ball-bearing frame construction for long life and smooth operation . . . one-piece, solid cast frame . . . close-grained smooth cast iron volute . . . are among the many big pump features you'll find in these moderate priced side suction centrifugals.

For a "cue" to better pump performance, choose the pumps that spell quality with a capital "Q" . . . Fairbanks-Morse Side Suction Centrifugals. Fairbanks, Morse & Co., 600 S. Michigan, Chicago 5, Ill.

FAIRBANKS-MORSE,

a name worth remembering when you want the best

PUMPS • DIESEL LOCOMOTIVES • ELECTRICAL MACHINERY • SCALES • HOME WATER SERVICE EQUIPMENT • RAIL CARS • FARM MACHINERY • MAGNETOS



EASY DOES IT!

'Load Lifter' SPEEDS TOUGH HANDLING

THE "SERIES 700" 'LOAD LIFTER' HOIST **is the one electric hoist you can depend on for continuous service to keep defense and civilian production on the move. It's a heavy-duty hoist, built for 3-shift lifting every day in the year.**

IT'S FAST AND ECONOMICAL **— Shortens handling time — lifts a ton 30 feet a minute. Costs go down when the 'Load Lifter' does all the heavy work.**

IT'S TOUGH AND SAFE **— The 'Load Lifter' has every feature to safeguard man, load and hoist. Only 24 volts at the push button. Powerful motor and load brakes that act simultaneously. Steel suspension. No exposed wiring. Over-capacity load hook.**

IT'S BUILT TO LAST **— Heat-treated helical gearing provides greater strength. Ball bearings throughout minimize frictional wear. The 'Load Lifter' is constructed with few parts to assure trouble-free service.**

SAVE IN YOUR PLANT **— Wipe out muscle strain and maintain worker efficiency. Give your production a lift at the same time. 'Load Lifter' capacities range from ½ ton up. Ask your "Shaw-Box" Distributor for details or write for Bulletin 399.**

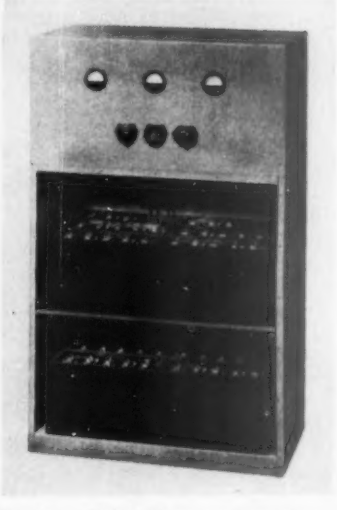
'Load Lifter'® ELECTRIC HOISTS

MANNING, MAXWELL & MOORE, INC.
MUSKEGON, MICHIGAN

Builders of "Shaw-Box" and 'Load Lifter' Cranes, 'Budgit' and 'Load Lifter' Hoists and other lifting specialties. Makers of 'Ashcroft' Gauges, 'Hancock' Valves, 'Consolidated' Safety and Relief Valves, and 'American' Industrial Instruments.

Begins on page 162

ELECTRICAL EQUIPMENT



Automatic Emergency Power System

This unit, called Light Warden, operates automatically and instantly in the event of power failure. Deriving its power from a bank of nickel-cadmium batteries, the emergency system can be used to supply power to lights, fire alarms, and public address systems.

The batteries are unconditionally guaranteed for 10 years' useful life and require water only once a year.

Electric Cord Co., 195 William St., New York 38.

■

FOOT POWER CONTROL, a reversing foot-operated toggle switch developed for welding positioner control, has been marketed by the Aronson Machine Co., Arcade, N. Y. The switch is designed for motor control where fast, safe, foot operation is required under rough conditions.

Turn the page

For Faster Materials Handling . . .

There's a **POWELL** Quick Emptying

Container To Fit Every Kind of Job

You can't beat quick emptying containers if you want faster materials handling . . . and you can't beat Powell when it comes to quick emptying containers. Pictured here are only a few of the many styles and types of quick emptying containers designed and built by Powell.

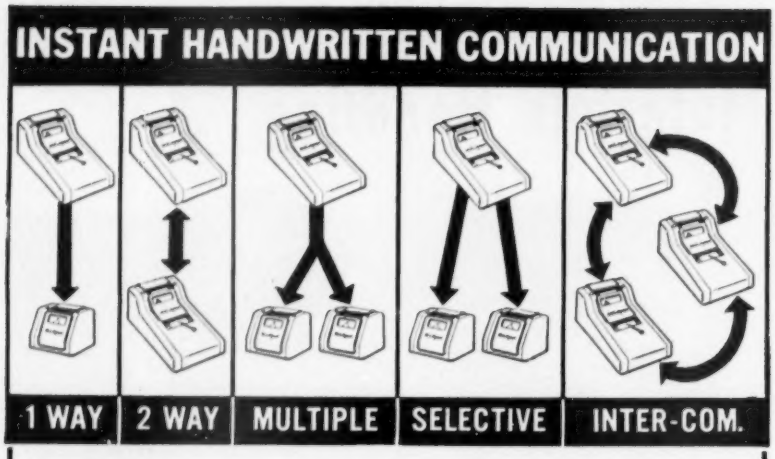
If this page gives you an idea for the speedier handling of your product, get in touch with the Powell representative in your area or write direct. Powell designs exactly what you need.

POWELL PRESSED STEEL Since 1920

THE POWELL PRESSED STEEL CO., HUBBARD, OHIO

ORIGINATORS OF ALL STEEL COLD FORMED MATERIALS HANDLING EQUIPMENT

(In Greater Youngstown)



How Flexible is Telescriber Communication?

Study the diagrams above and you will see that telescriber communication is as adaptable and as flexible as your needs demand.

1-WAY . . . . One transceiver writes to one receiver.

2-WAY (1) . . . Two transceivers write to each other.

MULTIPLE (1) . . . A transceiver writes to any number of receivers at the same time.

SELECTIVE (1) (2) . . . A transceiver selects any one—or any group—of receivers to write to at a specific time.

INTER-COMMUNICATING (1) (2) . . . Each transceiver on this system has full selectivity power to write to one, a group or all other transceivers in the system.

(1) A "lock-out" switch automatically prevents more than one message from being received on a receiver at the same time.

(2) Selector keys are required for Selective and Inter-Communicating systems.

For information concerning telescriber use in Production Control, Materials Handling, Quality Control, Maintenance Control, Work-in-Process Control, etc., write to Dept. B-33.

TelAutograph CORPORATION

16 West 61st Street • New York 23, N. Y.

Telescriber Service TelAutograph *

*Trade-Mark

Instan-Form *

NEW ELECTRICAL EQUIPMENT

Begins on page 180

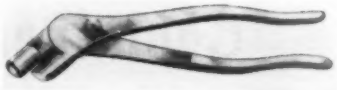
Flexible Conduit for Wet Locations

An extruded synthetic covering over the flexible metal core of Sealtite Type VA protects wiring against moisture, oil, dirt, chemicals, and corrosive fumes on permanent and temporary installations. This conduit is approved by the Underwriters' Laboratories for use in wet locations.

Conduit is moisture-proof, can be used to overcome problems of movement, vibration, and misalignment, indoors or outdoors. It is available in long lengths in nominal electrical ID sizes $\frac{3}{8}$ inch to $1\frac{1}{4}$ inches inclusive, the maker adds.

The American Brass Co., Waterbury, Conn.

■



Special-Purpose Pliers for Electricians

With these angle locknut pliers (No. 750-8) electricians can tighten locknuts in outlet boxes, remove burrs from steel tube and conduit, and cut or skin rubber wire insulation. You just clamp the material between a rotating roller jaw and a sharp-edged fixed jaw.

Utica Drop Forge Co., Utica, N. Y.

Turn the page

ELLIOTT CROCKER-WHEELER
Sealedpower MOTOR

Here's a motor that doesn't care how tough the conditions are. Blizzards of dust or grit can't affect it—not only can't get *in*, but can't even stay *on* the outer case. The powerful fan-driven, cowl-directed air blast sweeps it off, and also drives off the heat radiated from the many fins.

Easy to see why this Sealedpower motor has **for eleven years** been the ace-in-the-hole among engineers who are confronted with drive conditions that would defeat ordinary motors.

Thousands now in service, and going strong in oil refineries, lumber mills, chemical and textile plants, outdoor and indoor installations everywhere. 3 to 125 hp. Also as explosion-proof underwriters approved in most ratings. Get the facts. Address Elliott Company, Jeannette, Pa., or your nearest Elliott district office.

ELLIOTT COMPANY
Crocker-Wheeler Division
AMPERE, N. J.

For large motors: RIDGWAY DIV., RIDGWAY, PA.
Plants at: JEANNETTE, PA. • RIDGWAY, PA. AMPERE, N. J. • SPRINGFIELD, O. • NEWARK, N. J.
DISTRICT OFFICES IN PRINCIPAL CITIES
ELLIOTT APPROVED SERVICE SHOPS COVER THE COUNTRY

W2-8

safe, long-lasting
MAGCOA
light-weight HEAVY-DUTY
DOCKBOARDS
will cut your handling costs

Here is the valuable information about MAGCOA Light-weight HEAVY-DUTY DOCKBOARDS contained in this new bulletin.

- how they reduce dock accidents—protect men, equipment and loads—because they are light and easy to handle
- how they speed up loading and unloading
- how they are braced like a bridge and individually engineered for your requirements—built to last indefinitely
- how exclusive MAGCOA features make for greater maneuverability, prevent run-offs, prolong tire-life.

Above all, you'll discover why so many top industrial companies have standardized on MAGCOA Dockboards for freight car and truck loading *in all their plants.* At the same time, ask for new literature showing how Magcoa's magnesium fabricating experience and facilities can help you improve your products through use of light-weight, heavy-duty magnesium. Use the handy coupon.

MAGNESIUM COMPANY OF AMERICA
EAST CHICAGO, INDIANA — *Representatives in Principal Cities*

DIVISION OFFICES:
NEW YORK 20, 30 Rockefeller Plaza
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WASHINGTON 5, D.C., Walker Bldg.
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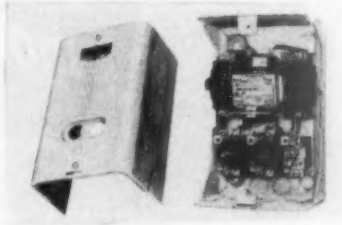
SAN FRANCISCO 4, Russ Bldg.

MAGNESIUM COMPANY OF AMERICA, East Chicago 5, Ind.
Please send ☐ Dockboard Bulletin ☐ Fabrication Folder
Name_____ Title_____
Company_____
Address_____
City_____ Zone_____ State_____

NEW ELECTRICAL EQUIPMENT

Begins on page 180



Magnetic Starters

Easy installation and maintenance are features of this new line of magnetic starters, contactors, and relays.

The NEMA size 0 starter has a wrap-around cover that pulls off to fully expose the front end and both sides of the unit. Each of the five independent units in the starter can be easily removed without disturbing another part.

A 3-coil adjustable overload relay permits you to get four ratings from each heater coil by changing its position. This results in protection within 3% of full-load motor rating. There's also good protection against single-phasing where unbalanced or unstable conditions can occur.

Double-break, silver-alloy contacts and armature and magnet coil can be removed and replaced without tools.

Cutler-Hammer, Inc., 312 N. 12th St., Milwaukee 1.

■

HAND HYDRAULIC TOOL which crimps the manufacturer's heavy-duty solderless terminals to standard or solid wire has been announced by Aircraft-Marine Products, Inc., Harrisburg, Pa. The self-contained unit has interchangeable die inserts.

■

SLIP-ON GUARDS prevent fluorescent lamps from falling from sockets despite heavy vibration and spreading of fixtures. These inexpensive guards are made by the Gets-A-Lite Co., 3865 N. Milwaukee Ave., Chicago 41.

Turn the page

BUS DUCT IS FLEXIBLE

Parke, Davis & Company plant modernizes with Westinghouse Bus Duct

"Neat . . . clean . . . flexible!", say Parke, Davis & Company engineers about the installation. The contractor reports, "My men liked installing Westinghouse Bus Duct . . . and the ease of mounting it around pipes, through walls and across wide open spaces saved us considerable time and money."

This vast installation of standardized Low Impedance and Plug-In Bus Duct has recently been completed at the Parke, Davis & Company, Detroit, Michigan, where a complete changeover was made from a d-c to an a-c system.

This duct has greater current-carrying capacity pound for pound than any other means of secondary power distribution. Plug-In Duct has outlets every foot to allow for rapid machine tie-ins. Duct sections are fully salvageable and can be expanded or relocated with little effort.

Four types of Westinghouse Bus Duct are available to meet any load condition and service requirement. Call your Westinghouse Representative for complete details or write for B—5835, Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna.

J-30107-A

YOU CAN BE SURE... IF IT'S Westinghouse

BUS DUCT

DESIGN TESTED AND VERIFIED in the Westinghouse HIGH POWER LABORATORY

A Message to Owners and Managers of Factories, Commercial Buildings and Institutions

Stop Covering your Roofs with Dollar Bills!

New Tropical Maintenance System Saves Money

- **Use Unskilled Labor—Cut Costs in Half!**
- **90% of Leaky Roofs Can Be Saved!**

You *can* make big savings in roof maintenance and avoid many of today's high costs of re-roofing and major repair, using the new Tropical Roof Maintenance System.

This System has been put in simple step-by-step book form. It is the product of long experience in formulating materials and supervising application on thousands of roofs of every size and type—from small store buildings to the acres of roof on automobile plants.

It shows where to look, and what to look for, to catch minor roof defects *before they become major defects!* Shows how *unskilled labor* can do your roof repairs quickly, economically. How to put extra years of life into a brittle, lifeless roof, and—where necessary—how to do a first-class re-roofing job at new low cost!

FREE! Write for Your Copy Today!

There are no secrets to doing top-notch roofing work. This book shows how unskilled labor can do it well and at big savings. Your business letterhead request for "Saving Old Roofs" brings your *free* copy. Write today!

THE TROPICAL PAINT & OIL COMPANY

1122-1252 W. 70th St., Cleveland 2, Ohio

Heavy-Duty Maintenance Paints Since 1883

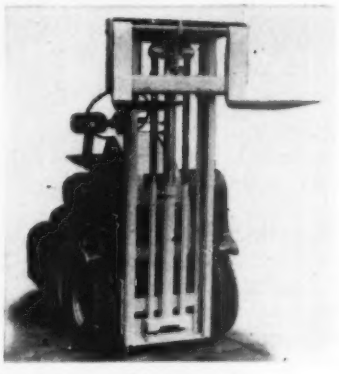
TROPICAL

Subsidiary of Parker Rust Proof Company

WHAT'S NEW IN EQUIPMENT

Begins on page 162

MATERIALS HANDLING



For Low-Clearance Stacking

"Freelift" accessory for Transitier Truck Co.'s Hi Duty lift truck line simplifies stacking inside a freight car, under a balcony —wherever you have low overhead clearance.

The all-hydraulic device permits you to lift the load several feet before the mast moves upward. Freelift will lift up to 5 feet 4 inches on a standard 9-ft. mast (which collapses to 6½ feet); and 4½ feet on a 7-ft. mast (which collapses to 5½ feet).

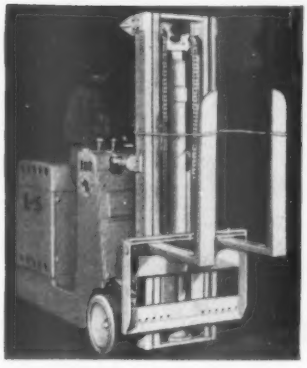
Transitier Truck Co., Portland 10, Ore.

■

TELESCOPIC TILTING FORK STACKER is available in capacities of 1500, 2000, 2500, and 3000 pounds from Clark Equipment Co., Powrworker Dept., Buchanan, Mich. All are rated at 24-in. center line of load. Two models: One has 83-in. over-all height with 64 inches of free lift and 130 inches maximum lift; the other is especially designed for highway truck loading, has over-all height of 68 inches, free lift of 49 inches, maximum lift of 100 inches.

Turn the page

HANDLING HELPS
by A.L.L.



Folding Forks

Here's an idea developed by G. E. They wanted to be able to operate this Lewis-Shepard Fork Truck on both 1st and 2nd floors . . . but its overall length was too much for their elevators. Solution: a simple addition of two rods holding the shaft-hung forks as they are swung to the up position. It cuts 15 inches off the length of the truck. Result: one SpaceMaster Electric Fork Truck going up.

A Handy Dandy

There are many types of hand operated equipment that can serve as valuable support to your power line. This L-S Handy Hoister is a good example. It is designed for one-man operation on loads up to 2000 lbs. It pushes easily on roller bearing wheels . . . floor lock prevents movement in racking. It may very well be the answer to a problem in your shop. Write for the full story. *Lewis-Shepard Products, Inc., 46-3 Walnut St., Watertown 72, Massachusetts.* ADV.

Modern handling saves $140,000 in one year
for S. D. Warren Co.

"We packaged our materials handling problems, and with a $52,000 initial investment in Lewis-Shepard Electric Fork Trucks and Tractors, realized a savings of over $140,000 in the first year of operation without adding any new buildings for storage," reports Mr. L. S. Pearson, Industrial Engineer at S. D. Warren Co., Cumberland Mills, Maine.

A recent addition to this efficient S. D. Warren handling system is the new Lewis-Shepard JackLift Electric Platform Type Truck, used for handling skid loads of paper.

This combination of L-S SpaceMaster Fork Lift Trucks and Tractors, plus the new JackLift Electric, continues to produce the same rate of savings. They operate 24-hours-a-day, 7-days-a-week . . . evidence of their quality and dependability.

These same savings could be yours. Send coupon today for full story of the new JackLift Electrics with capacities to 6000 lbs. . . . the quality trucks in the walkie field. Find out how they are helping to cut handling costs in all types of business and industry.

HERE'S MORE PROOF OF LEWIS-SHEPARD WALKIE TRUCK DEPENDABILITY

Listed are some current L-S reorders from blue-chip companies in various industries.

Motor Car	45 L-S in use — reordered	2
Grocery Chain	73 L-S in use — reordered	6
Chemical	14 L-S in use — reordered	5
Elec. Goods	194 L-S in use — reordered	14
Carbon Mfr.	23 L-S in use — reordered	4
Mfg. Chemicals	74 L-S in use — reordered	6
Glass Mfr.	12 L-S in use — reordered	2
Rubber Goods	5 L-S in use — reordered	3

Nationwide Service — See "Trucks Industrial" in your Yellow Phone Book

LEWIS-SHEPARD®

46-3 Walnut St., Watertown 72, Mass.

SEND FOR . . .

- JackLift Electric Catalog
- Electric Walkie Truck Comparison Chart
- Proof Folders showing L-S Trucks at work

The "MASTER" Line

Name _____

Company _____

Street _____

City _____

NOW YOU CAN PATCH OR RESURFACE CRACKED, PITTED WORN CONCRETE FLOORS with a MAT OF NEW CONCRETE!

Photo shows thinness of new surface-smooth feathered edge

For the first time in the history of building you now can bond concrete to concrete . . . with a bond stronger than the concrete itself... *a bond that never lets go!*

This bond is WELD-CRETE. WELD-CRETE is a liquid that is applied with brush, spraygun or roller. You merely broom-clean your old floor - - apply WELD-CRETE - - wait 40 minutes - - then trowel or pour on your *thin* topping of new concrete! Use it indoors or out - - on damp or dry surfaces - - in sub-zero or boiling-point temperatures. It will bond concrete to concrete, wood, metal, stone - almost *any* surface, porous or non-absorptive. And the concrete is there to stay - permanently - - no WELD-CRETE bond has EVER LET GO!

Write for folder; name of nearest distributors; and name of finest architectural, construction and contracting firms who have investigated WELD-CRETE and now swear by it!

WELD-CRETE

the wonder-working Bonding Agent that never lets go

LARSEN PRODUCTS CORP.

ELM ST., BETHESDA, MARYLAND

For bonding PLASTER use PLASTER-WELD

MATERIALS HANDLING EQUIPMENT

Begins on page 186

Shovel Hand Truck

You can make barrels, hampers, and cases seem lots lighter with this handy shovel truck.

It's all-welded, weighs 50 pounds. A heavy steel noseplate tapers for quick positioning of loads from 19 inches at the base to 13 inches at the tip.

The Palmer-Shile Co., Detroit 27, Mich.

■

Battery-Powered Hydraulic Elevator

The Hydra-Powrlift hydraulic elevator will lift 1000-lb. loads up to 60 inches in less than 30 seconds.

It raises from a lowered height of 5½ inches at a rate of 11 feet per minute. Unit is 81 inches high and 32 inches wide. Platform is 24 inches square.

The lift is equipped with automatic stops and push-button controls. Powered by 6-volt battery.

Langley Mfg. Co., 955 Cambridge St., Cambridge, Mass.

■

TOWING TRACTOR, recently announced by Clark Equipment Co., Industrial Truck Div., Battle Creek, Mich., has a drawbar rating of 12,000 pounds. The Clarktor-120 features fluid coupling, heavy-duty axle, and low silhouette. Powered by a 6-cylinder, 16A Chrysler gasoline engine.

Turn the page

TO AVOID AIR LINE TROUBLES

...Use the know-how of your HANSEN Representative

THE HANSEN REPRESENTATIVE—

Quick-Connective Couplings Are His Business

BUT SO ARE AIR LINE PROBLEMS

REPRESENTATIVES

BALTIMORE	LOS ANGELES
BIRMINGHAM	LOUISVILLE
CHICAGO	MILWAUKEE
CLEVELAND	MINNEAPOLIS
DALLAS	NEW ORLEANS
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DENVER	ROCHESTER
DETROIT	SAN FRANCISCO
FT. WAYNE	SAVANNAH
HARTFORD	SEATTLE
KANSAS CITY	ST. LOUIS

MONTREAL
TORONTO VANCOUVER

Export Department: CLEVELAND

The main job of the Hansen representative is to supply you with exactly the right couplings for your particular requirements—where quick connection and disconnection will save you time and money.

There are, however, hundreds of plants that regularly make use of his experience to improve the overall performance of their fluid line circuits. Frequently when trouble arises, he can make suggestions which will effectively correct your difficulties.

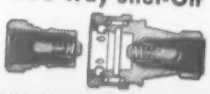
From years of experience in close contact with many types of hook-ups, both large and small, he can advise you on how to make pipe connections for proper take-off, how much and in what direction to pitch your lines, and where and how to install drains—all designed to give you more efficient, trouble-free performance of your air-operated devices.

QUICK-CONNECTIVE FLUID LINE COUPLINGS

1. QUICK CONNECTION AND DISCONNECTION
2. INSTANT AUTOMATIC FLOW OR SHUT-OFF

One-Way Shut-Off

Two-Way Shut-Off



ALSO STRAIGHT-THROUGH QUICK-CONNECTIVE COUPLINGS

Send for Catalog!

THE HANSEN MANUFACTURING COMPANY

4031 WEST 150th STREET • CLEVELAND 11, OHIO

These popular extra-handy RIDGID drop head dies give you clean threads fast and easily

★ Small, well balanced, clean cutting, these popular RIDGID ratchet threaders are a pleasure to work with. They save you time and effort because heads snap into drive ring from either side, won't fall out. Precision-cut alloy dies reverse for close-to-wall threads—no special dies needed.

★ 00R and 0R, 1/8" to 1"; 111R and 11R, 1/8" to 1¼"; 12R, 1/8" to 2". Conduit dies, too—and free carrier with sets. Buy them at your Supply House.

THE RIDGE TOOL COMPANY • ELYRIA, OHIO

RIDGID
Work-Saver Pipe Tools

MATERIALS HANDLING EQUIPMENT

Begins on page 186

Adjustable Length Conveyors

Here's a conveyor that will stretch out up to 220% over its closed length to fit your changing handling needs.

Adjustoveyor will carry loads of 50 to 100 pounds per linear foot, depending on the model. The power-operated, double boom will carry full loads over its entire length—from 8 to 16 feet on one model and from 25 to 61 feet on another.

It's available with fixed height or adjustable legs. Belt speeds are variable, either forward or reverse.

Stewart-Glapat Corp., Zanesville, Ohio.

■

Dual-Purpose Handling Unit

This unit can handle up to 4000-lb. loads two ways: as a hand truck and as a trailer unit for trackless-train operations.

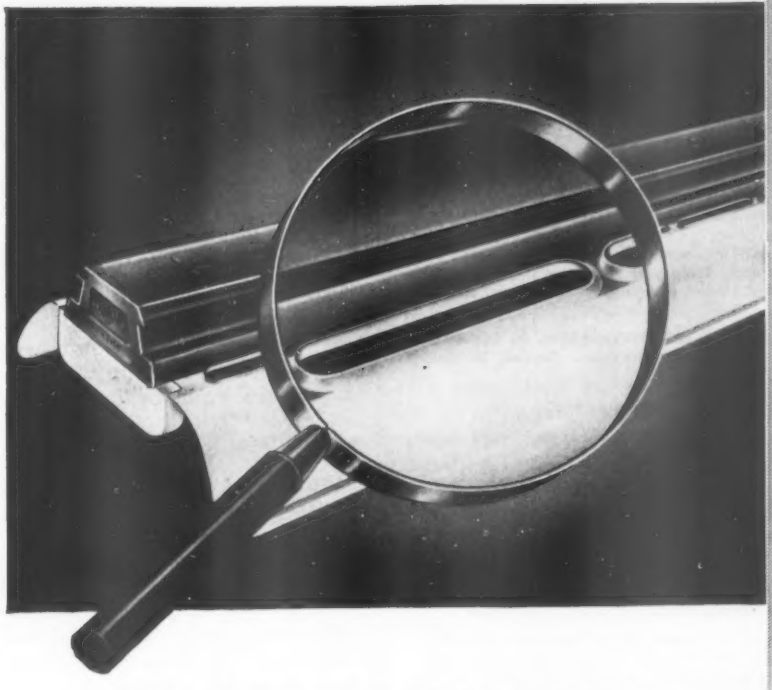
The all-steel caster-steer trailer has built-in brakes for easy manual load control on grades. You just depress a lever located on the caster-end pipe rack.

It's especially suitable for pallet loads. Flush-deck construction gives easy access to fork trucks. And self couplers on the end of each unit equip it for trackless-train hauling. Standard model is 36 x 62 inches. Platform is 13 inches from the floor. Wheels are

Day-Brite "Close-up" Quality

GIVES YOU EXTRA VALUE

for your plant lighting investment

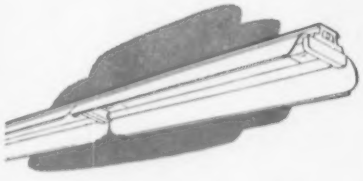


THIS IS A CLOSE-UP of the aperture in the reflector of a CFI DAY-LINE® industrial lighting fixture. These apertures are *die-embossed.* It would have been easier and quicker merely to stamp them out of the metal. But that would weaken the reflector—take away needed strength. Die-embossing retains strength and improves appearance.

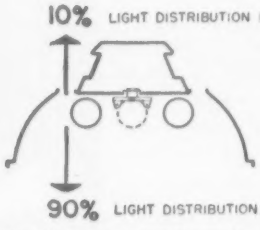
DIE-EMBOSSED APERTURES are Day-Brite's way of giving you up-lighting without sacrificing ruggedness—one of many "close-up" quality features that mean extra value to you.

88

"CFI" means COMFORT FOR INDUSTRY



The CFI DAY-LINE® was designed to make plant lighting comfortable. The more energy a man has to use in seeing, the less he has left to do his work. And if he's bothered by shadows and harsh brightness contrasts, he not only produces less—he's a prime prospect for costly "on-the-job" accidents, too.



The diagram above shows the principle used by the CFI DAY-LINE® to give you more comfortable plant lighting. 10% of the light is directed upward through scientifically placed, die-embossed apertures in the reflector. 90% of the light goes directly down to the work area.

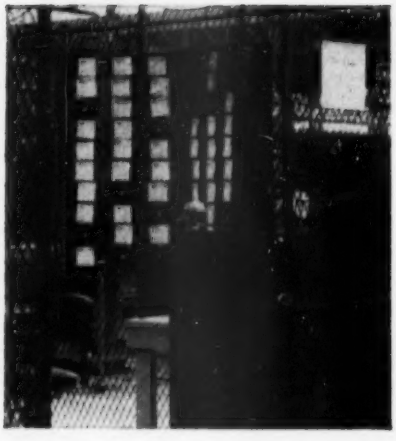
This direct-indirect distribution of light puts an end to dark ceilings and greatly reduces eye-disturbing brightness contrasts.

This greater comfort, plus the many Day-Brite "close-up" quality features —such as vibration-proof Turret* sockets on all units, all-white porcelain enameled reflectors, rust-inhibited parts, wiped reflector edges to eliminate chipping and crazing of the finish — make the CFI DAY-LINE the best industrial lighting value on the market today.

Write for full information. Ask for Bulletin OD-568. Day-Brite Lighting Inc., 5441 Bulwer Ave., St. Louis 7, Mo. In Canada: Amalgamated Electric Corp., Ltd., Toronto 6, Ontario.

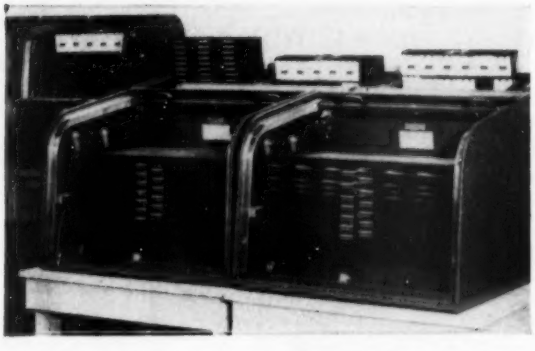
* ®G. E. Co.

"DECIDEDLY BETTER"
DAY-BRITE
Lighting Fixtures



How McCaskey Gage and Tool Inspection Control has helped achieve

HIGH QUALITY CONTROL STANDARDS in RECORD TIME in NEW AVCO PLANT



AVCO'S Bridgeport-Lycoming Division achieved high standards of Quality Control in their new plant in a very few months. The simplicity and effectiveness of McCaskey Control procedures were readily adapted to their needs and have played an important part in their entire program.

The following facts concerning it are taken from "Maximum Tool-and-Gage Control" by Harry M. Baldwin, General Foreman, Quality Control, Bridgeport-Lycoming Division, AVCO Manufacturing Corporation, Stratford, Conn. The article appeared in a recent issue of "Factory Management and Maintenance."

Their objectives were first, to place control of gages, tools and instruments in the department responsible for inspection of them, centralizing records and inspection. Second, to use a minimum of forms and filing equipment.

Their accomplishments in less than a year include:

. . . effective centralized control. No gages or measuring instruments out of tolerance are being used.

. . . low initial outlay for McCaskey visible clip-spring wall boards and cabinets with capacity available for growth to twice the items now handled.

. . . minimum paperwork and, as a result, low unit cost of control.

. . . rapid accumulation of information on history record cards from gage tags and other sources for dependable guidance in planning future activities.

Similar results can be accomplished in your plant with McCaskey Controls. You can adapt them to your requirements, as AVCO and numerous others, large and small, have done.

Let us send you Mr. Baldwin's complete article and additional information on McCaskey Gage and Tool Control. Our Industrial Specialists are available to work with you. They are well qualified by practical experience to offer constructive suggestions. No obligation, of course.

MAIL COUPON FOR COMPLETE INFORMATION

THE McCASKEY REGISTER CO.
ALLIANCE, OHIO

Please send me the AVCO Bridgeport-Lycoming article reprinted from "Factory" and additional information on McCaskey Gage and Tool Control.

Name .....

Position .....

Company .....

Address .....

FMM-3-53

McCaskey
INDUSTRIAL CONTROLS
PRODUCTION • INVENTORY
TOOLS • COSTS • PAYROLL
THE McCASKEY REGISTER CO.
ALLIANCE, OHIO
McCaskey Systems, Ltd., Galt, Canada
The McCaskey Register Co., Watford, England

MATERIALS HANDLING EQUIPMENT

Begins on page 186

molded-on rubber. Custom-made models to meet your specifications.

Mercury Mfg. Co., Chicago.

■

HEAVY-DUTY ROLLER CONVEYOR will take up to 600 pounds per roller. Sage Equipment Co., 31 Essex St., Buffalo 13, N. Y., has a line of standardized sizes in widths from 6 to 36 inches, and in 5-ft., 10-ft., and 90-deg. curves. You can order them with heavy-duty standard bearings, grease-packed, or dust-sealed bearings.

■

NEW BELT CONVEYOR ACCESSORIES are available for the Belt Versaveyor line put out by Belt Corp., Orient, Ohio. Included are a gravity-discharge section, powered-discharge section, gravity-feed section, powered-feed section and support stands for floor-to-floor applications without undercarriages. Special couplings and guide rails have also been developed for use with the manufacturer's equipment.

■

HEAVY-DUTY TRUCK-MOUNTED SHOVEL-CRANE has 6-ton capacity. The ⅜-yd. Model T-35 can be mounted on any tandem-axle truck having a wheel-base of 164 inches or more. You can use single-axle trucks when ground conditions are favorable. Or you can mount on pedestal or trailer, says Schield Bantam Co., Waverly, Iowa.

■

A LOW-COST FLOOR TRUCK, manufactured by the All-Steel Welded Truck Co., Rockford, Ill., is constructed with two complete arc-welded steel frames without any bolts or loose joints. The truck also has rounded corners for safety and a renewable deck for quick replacement.

Turn the page

Revere Camera's shipping room says, "Blue Ribbon gives us an added margin of safety."

"Blue Ribbon Superstandard Gummed Tape cut our damage claims 15%"

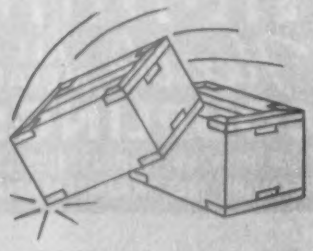
says Revere Camera Company

The 15% saving Revere Camera Company gained shows how Blue Ribbon Superstandard Gummed Tape *pays off!* Says Revere:

"Revere Camera has earned a reputation for giving customers good service. Blue Ribbon is helping us build that reputation by getting our shipments through in A-1 condition. Since we shifted to this superstandard tape, we have cut our damage claims on taped cartons by 15% or more. The adhesive is far more positive acting, and the kraft is exceptionally strong."

Try this superbly engineered tape just one month. You'll see the economies!

Did you know?



Only Gummed Tape reinforces your cartons

Unlike other methods, Gummed Tape is more than just a closure. The adhesive welds extra thicknesses of tough kraft to your carton—and reinforces it where most needed: at corners and seams. The tape becomes an integral part of your carton.

Because Gummed Tape is a flexible closure, it helps your carton absorb shock without damage. Stresses are distributed evenly, too, instead of being concentrated on a few isolated spots.

Gummed Tape gives your merchandise better protection against penetrating elements, too. It seals out smoke, dust, moisture, vermin. Your merchandise arrives at its destination as neat and spotless as when you packed it.

By using Gummed Tape with your company name imprinted, you can guard your shipments against undetected pilferage.

No other closure protects your shipments so many ways!

MAIL THE COUPON for fact-packed booklet

CONSISTENTLY SUPERIOR

Blue Ribbon

SUPERSTANDARD GUMMED TAPE

Available plain or printed, in choice of widths, weights, lengths and colors

HUDSON PULP & PAPER CORP.
Dept. 47, 505 Park Ave.,
New York 22, N. Y.

"HOW TO CUT COSTS IN YOUR SHIPPING ROOM"

Hudson Pulp & Paper Corp., Dept. 47
505 Park Avenue, New York 22, N.Y.

Please send me your helpful booklet, "How to cut costs in your shipping room."

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COMPANY _____

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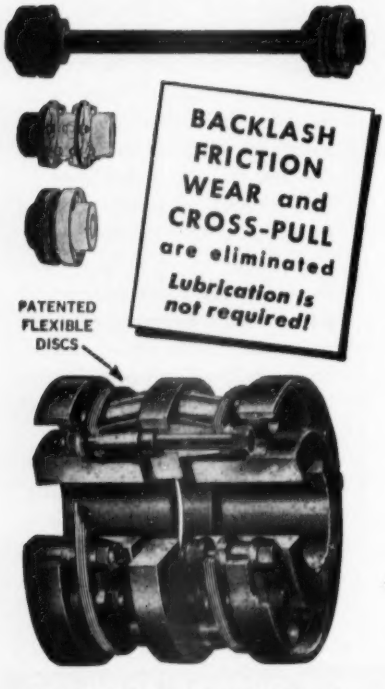
CITY _____ ZONE _____ STATE _____

THOMAS
Flexible ALL METAL
COUPLINGS
FOR POWER TRANSMISSION
REQUIRE NO MAINTENANCE

Patented Flexible Disc Rings of special steel transmit the power and provide for misalignment and end float.

Thomas Couplings have a wide range of speeds, horsepower and shaft sizes:
½ to 40,000 HP
1 to 30,000 RPM

Specialists on Couplings for more than 30 years



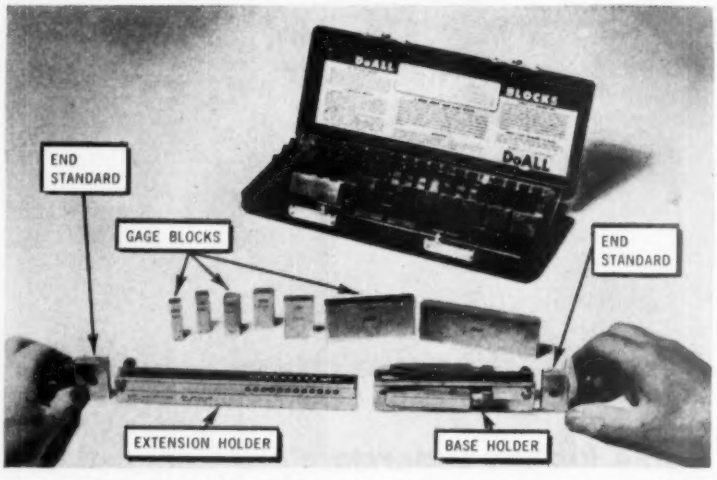
THE THOMAS PRINCIPLE GUARANTEES PERFECT BALANCE UNDER ALL CONDITIONS OF MISALIGNMENT.
NO MAINTENANCE PROBLEMS.
ALL PARTS ARE SOLIDLY BOLTED TOGETHER.

Write for the latest reprint of our Engineering Catalog.

THOMAS FLEXIBLE COUPLING CO.
WARREN, PENNSYLVANIA

WHAT'S NEW IN EQUIPMENT . . . *Begins on page 162*

MEASURING & CONTROL



ASSEMBLING A PRECISION HEIGHT GAGE WITH DO-ALL'S NEW BLOCKS.

Micro-Step Gaging System

With DoALL's new micro-step gaging system you can assemble gage blocks into usable precision gages and layout instruments. The company says it:

- Cuts gage and instrument expense because you can make them with this gage-block system.
- Reduces errors in transferring measurements from gage block to other instruments.

The basic features of the system that make it possible to assemble gages are gage-block holders and end standards.

The holders accommodate gage-block inserts, in increments of as little as 25-millionths of an inch, from 2 to 72 inches long. There's also a 1-in. to 6-in. caliper holder.

EXTRA-LONG GAGE BLOCKS and holder make up this large-size indicating snap gage.

The end standards are functional gage blocks (within gage-block tolerances) in a variety of forms. Each is designed to become a key part of a special type of instrument. There are a foot block, a sapphire ball-point end, knife-edge caliper bars, a scriber, a "pre-calibrated" dial indicator set, and others.

The system makes up instruments for a wide variety of tool and die work, layout, and inspection.

The DoALL Company, 254 N. Laurel Ave., Des Plaines, Ill.

Turn the page

HOW TO SQUEEZE MORE DOLLARS OUT OF YOUR PRODUCTION BUDGET

THE GOULD PLUS-PERFORMANCE PLAN— A library of technical information that tells you how to select, charge, maintain and determine the condition of lead-acid batteries. It's free. Write Gould Battery Information Headquarters.

There are two sure ways to make your production dollars go farther:
1) Power your industrial trucks with Gould "Thirty" Batteries;
2) Maintain *all* your batteries, regardless of make, with the Gould Plus-Performance Plan described at the left.

Here is complete assurance of maximum battery performance throughout longest possible service life. For real materials handling economy, take advantage of this cost-cutting combination . . . write for full information on Gould "Thirty" Batteries and the Plus-Performance Plan.

GOULD *Industrial Batteries*

GOULD-NATIONAL BATTERIES, INC., TRENTON 7, N. J.

Always Use Gould-National Automobile and Truck Batteries

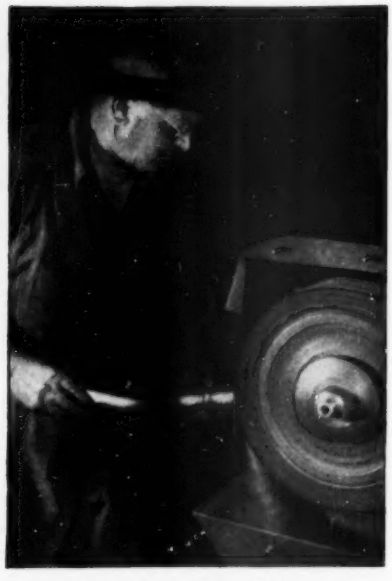
Backstand Belts save 2 hours per day!

Armour Backstand Belts save 2 full hours per operator per day for steel tube company*

In removing burrs and grip marks from steel tubing, a well-known company* found they saved more than just the two hours per day operators had been given to make set-up wheels. Backstand belts outlast 4 to 5 set-up wheels—and without dressing they remain flat and true. And backstand belts give a better finish, due to their uniform grit.

Belts are only one of the many forms of Armour coated abrasives. There are more than 30,000 different varieties in grit size, backing, etc. We have sheets, discs, rolls, tubes—and specialties to meet your specifications. Your industrial supply distributor will tell you about this complete line. Call him today!

And, today—mail the coupon below for your free copy of our booklet, "How to Store Coated Abrasives." It can help you, too!



*Name of company available on request

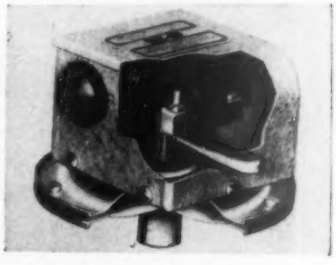
We recommend buying through your industrial distributor

MAIL THIS COUPON TODAY!
Armour and Company • North Benton Road • Alliance, O.
Please send me the free booklet, "How to Store Coated Abrasives."

Name..... *Title*.....
Firm.....
Address.....
City..... *Zone*.... *State*.....
F

MEASURING & CONTROL EQUIPMENT

Begins on page 194



Low-Level Liquid Limit Switch

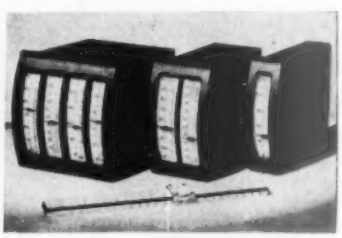
Now you can have protection where the safety of equipment depends on a suction-fed lube, fuel, water, or other liquid. The Vac-on switch shuts off the power source when the liquid supply runs dry.

For motors, you mount the switch on the suction line and wire it into your power supply. You can protect motors up to 2 hp. a-c or ½ hp. d-c. For gasoline engines, mount the switch on the suction line and wire it into your spark system. If liquid runs dry, the spark plug is shorted.

Operates on a spring-loaded rubber-diaphragm principle. Silver contact points for heavy-duty service.

Jaycon Associates, 404 N. Washington Ave., Minneapolis, Minn.

■



For Space Saving on Panelboards

When instrument space on your graphic or process control panelboard is at a premium you'll find a friend in Mindicators.

These vertical-scale indicating instruments require a panel opening of only 5⅜ x 1½ inches for single units, and 1⅜ inches more

You get ALL these Features when you buy PET Drills!

Reserve Power—for the extra-tough job.
Powerful, Continuous-Duty Motors—built in PET's own factory. Dynamically Balanced Armatures—for freedom from vibration.
Six Heavy-Duty Ball and Needle Bearings.
Compact Design—makes hard-to-reach drilling jobs easier and faster.
Aluminum-Alloy Die Castings—for light weight, easy handling.
Forced Ventilation—for cool running.
Precision-Cut, Heat-Treated Gears—for smooth, quiet power flow.

If you want the *best* for your maintenance or production work, take an extra look at the PET Superduty Drill shown here. Check its features! Here's a drill that's made for heavy, continuous duty...with *plus* power per pound . . . built to *work* right and *handle* right on the job.

Normally you might expect to pay extra for such features—in the form of "optionals" that jack up your cost. But that's not true of PET Drills! All these features are standard in the PET Superduty line . . . *and they're available to you at a standard drill price!* That's why the coupon below can save money for you. For free catalog and name of your nearest PET distributor, *mail it today!*

NOW...you can get the RIGHT DRILL for YOUR job!

PET Superduty Drills are available in 54 distinct models and 3 capacities: ¼", ⅜" and ½". Your choice of pistol or saw-type grip. With such a broad line, you don't have to compromise on a drill that's "almost" right! You can choose *exactly* the drill you need for your job. The PET Superduty line includes drills meeting U. S. Government and military specifications.

PET® POWER TOOLS

Plus Power per Pound

PORTABLE ELECTRIC TOOLS, INC.

320 West 83rd Street, Chicago 20, Illinois

In Canada: Portable Electric Tools, Ltd., 452 Birchmount Road, Toronto 13, Ontario, Canada

MAIL COUPON FOR FULL INFORMATION

PORTABLE ELECTRIC TOOLS, INC. FM-33
320 W. 83rd St., Chicago 20, Ill.

Gentlemen: Please send us free copy of your PET Superduty catalog, and name of nearest distributor.

*Name*_____ *Title*_____

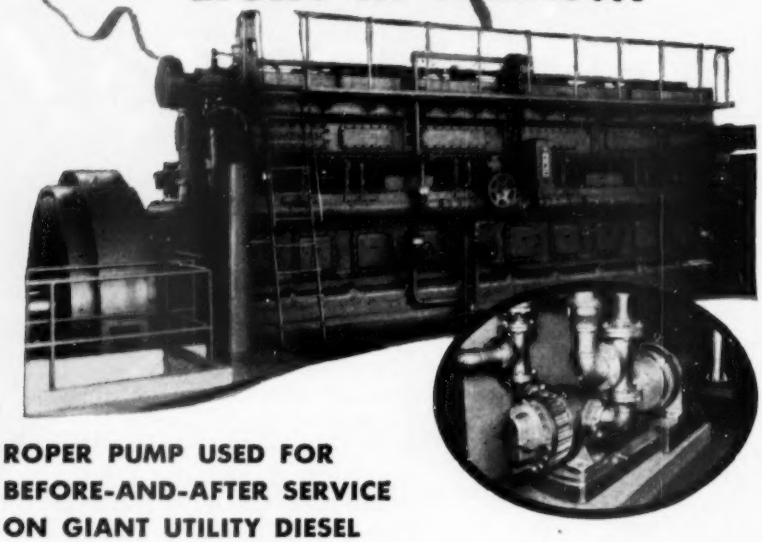
*Company*_____

*Address*_____

*City*_____ *State*_____

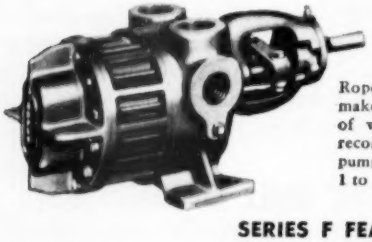
ROPER

HELPS TO SHED SOME LIGHT IN TEXAS...



ROPER PUMP USED FOR BEFORE-AND-AFTER SERVICE ON GIANT UTILITY DIESEL

In big Texas, a small (by comparison) Roper 25F100 Pump with packed box is used to circulate lubricating oil for before and after operation on a big Fairbanks-Morse dual-fuel diesel. The operators of this Weatherford, Texas municipal power plant use a heavy duty, detergent oil for the lubricating system . . . the motor-driven Roper delivers this oil to bearings and (for cooling) to the pistons. Yes, Roper helps to shed some light and power in Texas . . . and Roper *dependability* is a very necessary quality in such an important installation.



PLAN WITH ROPER TO DO A JOB FOR YOU

Roper Series F Pumps have many features which make them widely adaptable to numerous types of work pumping clean liquids. They are recommended for pressures to 300 P.S.I. when pumping lubricating oils. Sizes range from 1 to 300 G.P.M.

SERIES F FEATURES

CONSTRUCTION . . . Supplied in standard fitted or stainless steel fitted models to suit specific needs.

GEARS & DRIVE . . . Two equal size helical pumping gears run in axial hydraulic balance. Shafts are hardened and precision ground.

SEALS . . . Packed Box or Mechanical Seal construction available. Models with built-in relief valve can be furnished.

DESIGN . . . Roper principle of only 2 moving parts permits simplicity of design . . . such design offers high efficiency and long service life.

Send for Factual Folder Today

GEO. D. ROPER CORPORATION
183 Blackhawk Park Ave., Rockford, Ill.

ROPER
Rotary Pumps

Begins on page 194

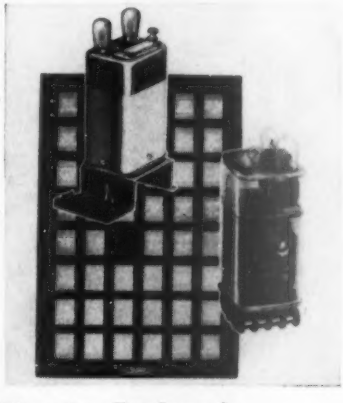
in width for each additional unit. You just stack the units flush against each other.

You can remove one or more independent instruments from a housing without disturbing adjacent units.

Thermometers come in any scale range from −200F. to +1000F. Pressure gages are available in scales from a low of 0 to 10 psig. to as high as 0 to 1000 psig.

The Dickson Co., 7420 Woodlawn Ave., Chicago 19.

■



Plug-In, Enclosed Relay Unit

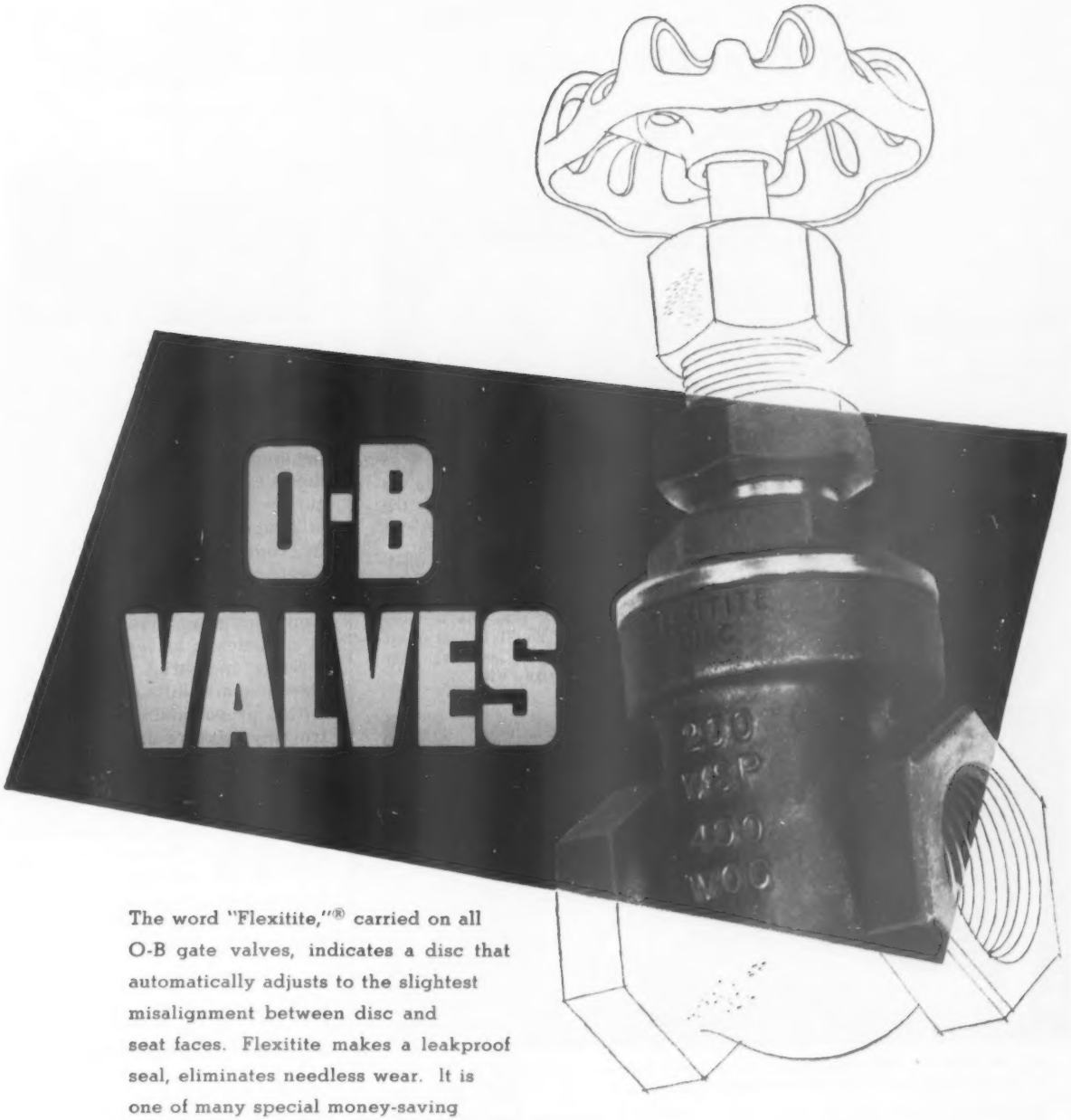
Plug-in signal relay units make possible quick assembly and easy maintenance of signaling equipment.

The "LPG" units are completely enclosed, dustproof, and easy to take apart. Maker claims they're less expensive, but just as flexible and versatile as hermetically-sealed units.

They come in more than 100 standard circuits. On many you can make fast changes in operating sequences with simple terminal connections. Unitized construction makes it easy to assemble relay units into multiple stations, from one to many hundreds in the same system.

Tigerman Engineering Co., 4332 N. Western Ave., Chicago.

Turn the page



The word "Flexitite,"® carried on all O-B gate valves, indicates a disc that automatically adjusts to the slightest misalignment between disc and seat faces. Flexitite makes a leakproof seal, eliminates needless wear. It is one of many special money-saving features available in O-B valves. Ask your distributor about them.

Ohio Brass

MANSFIELD OHIO, U. S. A.

BRONZE GLOBES, ANGLES, GATES AND CHECKS FOR INDUSTRIAL SERVICE

4371-V

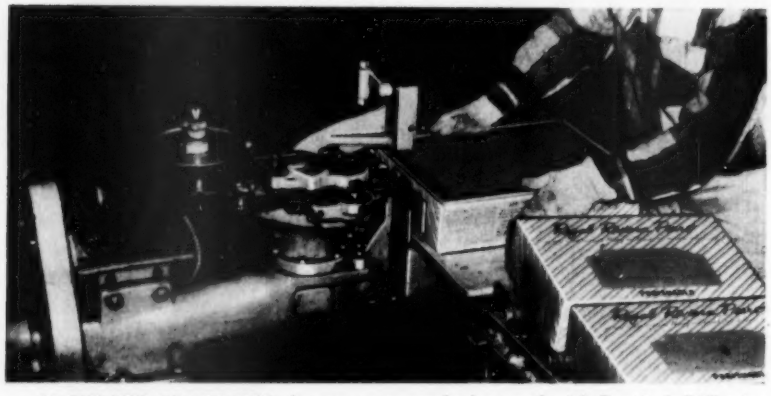
CAN YOU SPOT THE 90¢ DIFFERENCE ?

The two boxes are almost identical. One is tied with wire. The other shows how Bostitch field men can cut costs—the lid of the box is fastened to the bottom with just *four* wire staples.

By switching to Bostitch, this fruit packer was able to save 90c out of every dollar formerly spent for wire.

And that's not all. The packer further reports that his boxes look better, stack better, travel better. His shipping-room employees are a lot happier. And his customers say the boxes are easier to open and the fruit is less likely to be bruised.

Whatever business you're in, whatever your present method for closing cartons or fastening materials, you'll do well to check into the services Bostitch offers. You'll be surprised how many different fastening jobs Bostitch can help you with.



AT THE END OF THE LINE, boxes are securely fastened with Bostitch S2B wire stitchers. Bostitch makes 30 different machines for doing all kinds of shipping-room jobs.

FREE BULLETIN *describes 30 of the 800 Bostitch models used for wrapping or packaging. Just mark and mail the coupon.*

THERE'S A BOSTITCH MAN NEAR YOU— *300 field men in 125 cities in the U. S. and Canada. Bostitch service is always nearby.*

BOSTITCH, 603 Mechanic Street, Westerly, R. I.

Please send me a free copy of your bulletin on Bostitch stapling machines for shipping-room use.

I am particularly interested in a better and faster method for:

☐ Assembling cartons ☐ Sealing corrugated wrappers ☐ Covering barrels
☐ Bottoming ☐ Repairing cartons for re-use ☐ Tagging
☐ Top-sealing ☐ Bag-sealing Other _____

Name _____

Company _____

Address _____

City _____ *Zone* _____ *State* _____

BOSTITCH®

fastens it better, AND FASTER with wire

ALL TYPES OF MACHINES FOR APPLYING STAPLES
ALL TYPES OF STAPLES APPLIED BY MACHINES

MEASURING & CONTROL EQUIPMENT

Begins on page 194

Flowmeter Measures Mass Only

This instrument measures the true mass rate of flow in pounds per minute of anything that will flow or fall through a pipe. Accuracy is completely independent of temperature, pressure, viscosity, compressibility, and external accelerations, as well as volume. So you can use the same instrument for gases, liquids, slurries, or particles in an air stream.

Some industrial applications: Two or more units could be used with a proportioning unit to control any mixture in an industrial process. In chemical plants, the flowmeter could be used for weight-mixing control.

Meters will be custom-built to specifications. The most vital industrial and military needs will be met first, says the maker.

Control Engineering Corp., Norwood 88, Mass.

■

For Remote Control of Plant Operations

You can use sound waves to initiate any operation that can be remotely controlled by a relay. It's easy work for Motorola's new single-tone selective signaling system.

You transmit the fixed-frequency sound signal through any communications medium—2-way radio, land lines, microwave, or power-line carrier. A decoder picks up the transmitted tone and operates a relay to start the desired operation.

A 10-button selector box can control 10 operations or groups of operations. When several decoders are connected in parallel

When You Need Speed

J&L is Way Up Front!

NO "SUNDAY DRIVER" HERE!

It's just as easy as it looks for Warehouse delivery to beat everything on the road! Just pick up your phone and dial J&L's Steel Service Station. We'll speed your order to your door. It's the quickest, most convenient method for ordering the steel you need. In addition to the regular steel products—you can also get speedy service on such special J&L items as Jalloy, Otiscoloy, Jr. Beams, Jr. Channels, Jal-tread and the new J&L "1200" Cold Finished steels.

J&L WAREHOUSES

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CINCINNATI 2, OHIO.....MAin 2323
DETROIT 7, MICHIGAN.....WAlnut 1-0470
MEMPHIS 1, TENN.....5-1625
NEW ORLEANS 6, LA.....FRanklin 1131
PITTSBURGH 3, PA.....HEmlock 1-1000
LONG ISLAND CITY 1, N.Y.....RAvenswood 9-8700

For a Complete Line of Steels

Hot Rolled and Cold Finished Bars and Shapes • Structural Shapes • Carbon and Hi-Tensile Plates • Hot and Cold Rolled Strip and Sheets • Wire Products • *"Precisionbilt"* Wire Rope.

JONES & LAUGHLIN STEEL CORPORATION
PITTSBURGH 30, PA.

Cut Your Maintenance Costs
WITH
Milwaukee SAWZALL

Not an attachment...but the NEW single unit, heavy-duty
PORTABLE ELECTRIC HACKSAW

As its name implies, Milwaukee SAWZALL cuts *any material* with amazing new speed and efficiency . . . serves hundreds of *new uses* in the shop, factory, and on the job . . . saves up to 75% of previous sawing costs . . . pays for itself quickly.

Powered for Tough Jobs
2250 strokes per minute (¾" stroke) . . . equipped with the *Milwaukee-Built* Motor, famous for more "motor guts" . . . lifetime lubricated ball and roller bearings . . . weighs only 6¼ lbs. . . . and fully guaranteed.

One-hand Control
No chucking problems or coupling difficulties
Cooler operation

Complete with Steel Carrying Case and Blades for cutting all materials **$78.50**

Speediest and safest method of opening crates. Breezes through nails and metal bands. Leaves crates in perfect condition for re-use.

Also ideal for accurate cutting of sheet metal, including corrugated aluminum. In plant maintenance, Milwaukee SAWZALL saves up to 78% of labor cost.

Call your Distributor or write us for complete information. Ask for Folder SW-5.

MILWAUKEE ELECTRIC TOOL CORPORATION

Portable Electric Drills, Saws, Screwdrivers, Hammers, Aerial and Bench Grinders, Sanders and Polishers

5346 West State Street • Milwaukee 8, Wisconsin

Canadian Distributor: **MATTHEW MOODY & SONS CO., Montreal**

on a single receiver, you can perform different operations at the same time.

There's no danger that the decoder will be accidentally triggered by tones of nearby frequencies, the maker claims.

Motorola, Inc., 4545 Augusta Blvd., Chicago 51.

■

Safety Pressure Gage

You take no chances when you view this pressure gage. A solid wall on the Ashcroft Maxisafe Duraguage separates the dial from the gage movement and tube. And a safety-release plate which covers the entire back of the case permits discharge of the pressure media away from the viewer.

You can get the gages in pressures from 15 to 100,000 psi.

Manning, Maxwell & Moore, Inc., Stratford, Conn.

■

For Detecting Electrical Defects

Here's help in quick detection of electrical defects in hand tools and extension cords. With the Pow-R-Safe tool tester, electrically untrained people can test equipment to guard against failure of insulation and grounds and short circuits. It weighs 6 pounds, is completely portable.

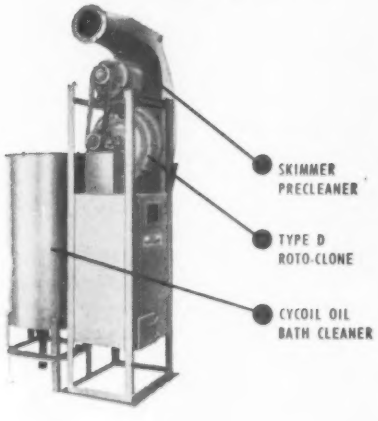
Fendall Co., 4633 N. Western Ave., Chicago 25.

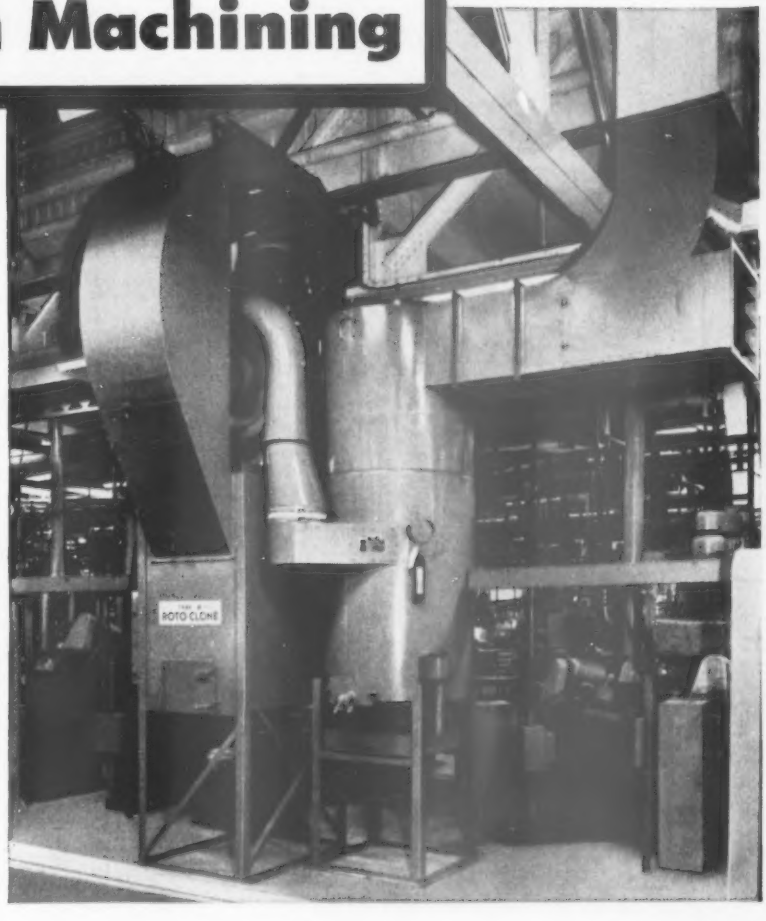
Turn the page

Stop Cast Iron Dust from Production Machining

ROTO-CLONE

permits savings, too, through recirculation of cleaned air





You "clean up" two ways with the application of ROTO-CLONE* dust control to cast iron machining operations. One, worker and workroom are free from the grime of this fine carbon and metal dust. Two, you enjoy definite fuel savings during the heating season. Reason—ROTO-CLONE'S complete cleaning action permits recirculation of the exhaust air to the work area.

Designed specifically for this service, the Model R Self-Contained ROTO-CLONE is actually a three-phase collection assembly. First, the chips are removed by a Skimmer Precleaner. Next, bulk of dust is collected by a Type D ROTO-CLONE. Lastly, the remaining fines are collected as a sludge by a TO-8 Cycoil Oil Bath Air Cleaner. Final result—99% cleaning efficiency achieved by a unit requiring a minimum of floor space and maintenance.

Is it field-tested? Today, 27 installations of Model R ROTO-CLONES are *recirculating* 1,300,000 cfm from cast iron machining operations. Let us show you how to clean up cast iron dust at a neat saving. Just call your local AAF representative or write us direct for complete product and performance data.

**ROTO-CLONE is the trade-mark (Reg. U. S. Pat. Off.) of the American Air Filter Company, Inc., for various dust collectors of the dynamic precipitator and hydrostatic precipitator types.*

American Air Filter
COMPANY, INC.
361 Central Avenue, Louisville 8, Kentucky
American Air Filter of Canada, Ltd., Montreal, P. Q. • Pacific Division Office, San Francisco, Cal.

AAF

OUT OUR WAY
MAKIN' SKATES ON COMPANY TIME, HAH! OKAY, LET IT END THERE! DON'T LET ME KETCH YOU TRYIN' TO MAKE A RINK TO GO WITH 'EM!
I CALL MAKIN' SKATES COMPANY BUSINESS! YOU NEED 'EM AROUND HERE WITH THESE OILY, GREASY FLOORS!
YEAH--SOMEONE OUGHT TO TELL TH' BOSS ABOUT SOL-SPEEDI-DRI!
MACHI OIL
J.R.WILLIAMS
THE UNDERCOVER ARTIST

Tops the field—in sales and value!

SOL-SPEEDI-DRI

"Dry cleaning" with Sol-Speedi-Dri is industry's favorite way to keep floors clean and slip-proof. Sol-Speedi-Dri is the largest selling oil and grease absorbent in the country. That's because pound for pound, dollar for dollar, it gives you *more for your money*, all factors considered. You can count on consistent quality, too—careful laboratory controls see to that. Send coupon today for free sample and literature.

SPEEDI-DRI CORP. 218 W. Washington Sq., Philadelphia 5, Pa.

Warehouse stocks maintained in principal cities of the United States and Canada.

• • •

Inquirers in New York, New England, and New Jersey should write to Speedi-Dri Corp. Elsewhere in U.S. to Waverly Petroleum Products Co., 1724 Chestnut St., Phila. 3, Pa. In Canada, G. H. Wood & Company Ltd., Toronto. Branches throughout Canada.

FREE SAMPLE Fill out the coupon and mail today for free sample and literature.

*Name*_____

*Address*_____

*City*_____ *State*_____

FMM 3-53

Begins on page 162

PAINTS & PROTECTIVE COATINGS

Vinyl Primer for Rusty Steel

A primer for vinyl finishes will cover and adhere to light coatings of rust. And it will prevent further rusting in atmospheres that corrode steel slowly, maker says.

You brush on Rustbond Primer with no further need for metal preparation. Can be used as a base for rubber-base, Neoprene, and other corrosion-resistant coatings, also.

The primer covers sharp and rough edges as heavily as flat surfaces. It's unplasticized and won't burn in an ordinary flame. It possesses good corrosion resistance to most acids and solvents after aging. After 8 weeks it resists the action of common paint removers; after 5 months it adheres even better.

Carboline Co., 7603 Forsyth Blvd., St. Louis, Mo.

■

VINYL SEALER prevents asphalt, coal-tar, and Gilsonite materials from being dissolved by coatings containing active solvents. Sealer P-25M, says Prufcoat Laboratories, Inc., 50 E. 2nd St., New York 17, will form effective barrier film over any surface.

■

SPECIAL ROOFING BITUMEN can be used as an alternative to coal-tar pitch in applying built-up roofs, according to Ruberoid Co., 500 Fifth Ave., New York 36. You can apply it exactly like coal-tar pitch.

Turn the page

WHY RISK SHUTDOWNS?

WESTINGHOUSE INVENTORY PLAN GIVES YOU THE ELECTRONIC TUBES YOU NEED WHEN YOU NEED THEM

Switch from the old-fashioned method of searching for tube replacements — make sure you have 'em at your finger tips.

Production stoppages can be avoided. Here's how —

A reliable Westinghouse distributor will inventory your equipment and analyze your tube needs. He will prepare an ideal stocking plan. He will maintain a stock reserve specifically for you in his warehouse. This personalized stock is over and above your normal inventory of spare tubes you maintain for emergency breakdown.

Your Westinghouse distributor provides immediate service. In case of emergency, a call to him will bring your personalized tube replacement in a matter of minutes.

Why risk production losses any longer? Accident may strike today . . . tomorrow. Take advantage of the Westinghouse Inventory Plan as soon as possible. Call your Westinghouse distributor or write Dept. F-103.

YOU CAN BE SURE... IF IT'S Westinghouse

ET-95017

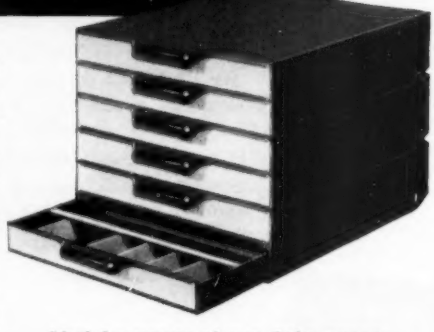
RELIATRON™ TUBES

WESTINGHOUSE ELECTRIC CORPORATION, ELECTRONIC TUBE DIVISION, ELMIRA, N. Y.

SEE PAGE 244

SPEED HANDLING OF TINY PARTS WITH NEW LITTLE GEM* CABINETS

The Little Gem is a ruggedly-built, all-steel two drawer storage unit that measures 11"x11"x3¼". Each drawer may be divided into as many as 28 instantly adjustable compartments through use of flush-fitting dividers. Sides and bottom are fully enclosed to prevent escape of even the tiniest parts. Front of compartment is curved for easy removal of parts . . . rear has ¾" overhang to prevent mixing of items when drawer is jerked open or slammed shut. Easily visible label holders on every compartment permit quick identification of all parts. The Little Gems may be used individually, in stacks, under counters, or on shelving. See them at your Equipto distributor or write us for free catalog.



Ideal for storage of nuts, bolts, screws, washers, bushings, packings, adaptors, springs, stems, small gears, etc.

*Trade Mark, Patent Pending

Equipto

Division of Aurora Equipment Company
825 Prairie Avenue, Aurora, Illinois
Steel Shelving . . . Parts Bins . . . Drawer Units

Begins on page 162

SAFETY & PLANT PROTECTION

Safety Ladder Has Dielectric Barrier

There's positive protection against electrical contact built into this "Sure-Step" aluminum ladder. A specially-installed dielectric barrier is available on request.

Other features of the ladder include non-slip 18-in.-wide flat step, safety shoes, and rubber bumpers at the top.

Comes in standard sizes in straight or extended sections.

The Hilton Mfg. Co., 1230 M15 W. Lisbon Ave., Milwaukee 16.

■

HEAT-RESISTANT SAFETY GOGGLES won't make wearer uncomfortable even at extremely hot foundry locations. Wherever the goggles touch the worker there's a non-toxic, heat-resistant, perspiration-proof vinyl binding. It's permanently stitched on the eye binders and bridges and its heat-sealed on the side shields. You can wash or sterilize them as often as you like, says American Optical Co., Southbridge, Mass.

Turn the page

Send for this booklet...

See what Stanoil offers you...

You'll find the means to significant savings in this booklet. It describes the important qualities of STANOIL Industrial Oil and the resultant benefits which have made this multi-purpose oil the choice of midwest manufacturers for a host of important lubricating jobs. Discover how STANOIL will give you superior protection through its unique combination of six outstanding characteristics, including high stability and effective rust prevention. Find how STANOIL can simplify stock, storage, and inventory in your plant by replacing special-purpose oils in hydraulic systems, speed reducers, air compressors, machine tools, electric motors, auxiliary turbines, and a wide variety of circulating, bath, and bearing systems. Ask the Standard Oil lubrication specialist from your nearby Standard Oil office for this booklet, or write: Standard Oil Company (Indiana), 910 S. Michigan Ave., Chicago.

Compressors give carbon the air

● When carbon formed on the valves of these air compressors and the oil in the crankcases had to be changed frequently, operators of this Midwest plant called in a Standard Oil lubrication specialist. He recommended STANOIL Industrial Oil, a multi-purpose oil having a low carbon-forming tendency and containing effective oxidation and corrosion inhibitors. With STANOIL, the compressors gave the air to carbon troubles and have breezed through four years of hard operation without difficulty. Over the oil previously used, STANOIL has given four times longer service in the crankcases. These results . . . similar to the results you may expect . . . have led to the use of STANOIL in other equipment in this plant.

STANOIL
TRADE MARK
Industrial Oil

Find how this multi-purpose oil can benefit you by discussing it with a Standard lubrication specialist. You can contact him by phoning your local Standard Oil office.

Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD OIL COMPANY STANDARD *(Indiana)*

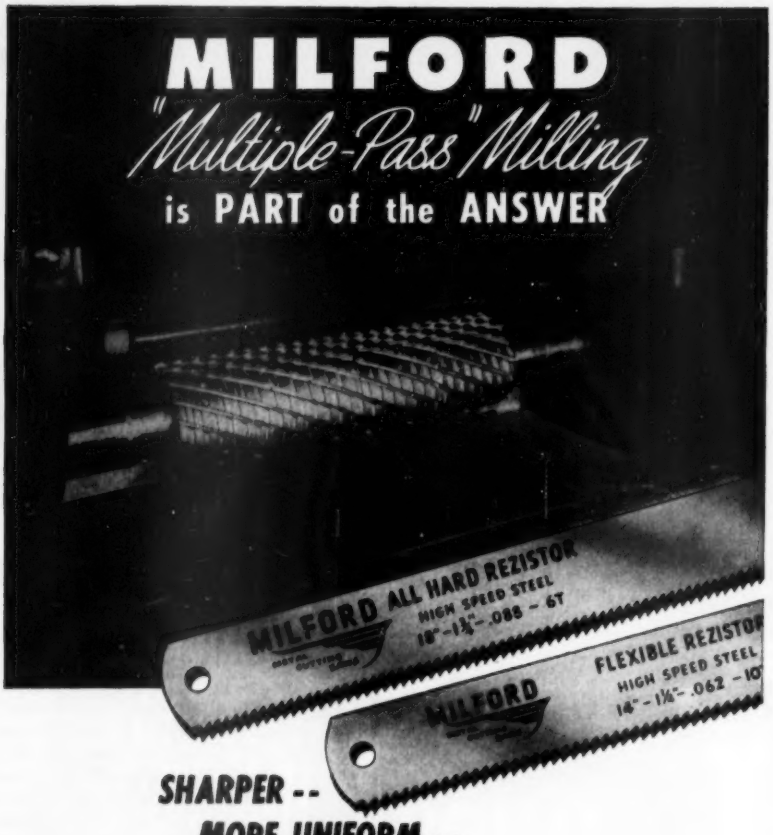
YOU CAN *Lower* YOUR

METAL CUTTING COSTS

MILFORD

"Multiple-Pass" Milling

is PART of the ANSWER



SHARPER --
MORE UNIFORM --
CLEANER TEETH --

Milled by multiple passes of the cutters, keener, more uniform teeth are produced, absolutely necessary for faster, smoother cutting of metals. The final burnishing pass produces the smoothly finished teeth, which assure fast, effective chip removal.

ALL MILFORD POWER HACK SAW BLADES . . . give you faster cutting with teeth that are sharp, and stay sharp longer.

STANDARD OF QUALITY THE WORLD OVER

THE HENRY G. THOMPSON & SON CO.

SAW BLADE SPECIALISTS
FOR OVER 75 YEARS
NEW HAVEN 5, CONNECTICUT
PROFILE BLADES AND BAND SAW BLADES
HAND AND POWER HACK SAW BLADES

MILFORD

Sold through MILFORD Distributors who render a service tailored to your needs. The Industrial distributor is familiar with the requirements of industrial users in his area. His is a prompt personalized service, as near as your telephone.

SAFETY & PLANT PROTECTION

Begins on page 206

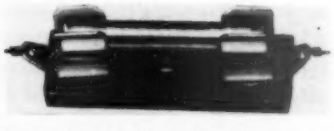
All-Shade Attachment for Welder's Helmet

No more time wasted in changing welder's lenses when switching from one type of work to another. Not with the Vari-Shade. All you need do to get more or less shade is flick the rotating attachment. It's designed to fit all standard welder's helmets.

Polacoat claims it's especially good for starting and welding on close work where you want to see your work without running risk of burns or eye damage with the hood up. After the arc is struck, you just adjust Vari-Shade for the required intensity. It's said to give complete protection in shades from 6 to 12.

Polacoat, Inc., 9794 Conklin Rd., Blue Ash, Ohio.

■

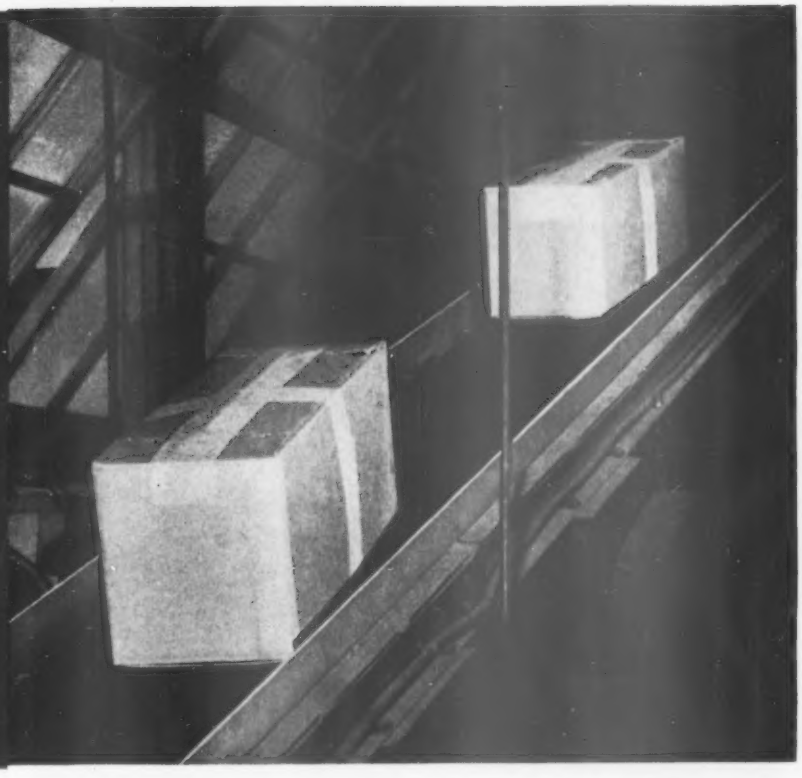


Fire Detection System

The Rexalarm, which the maker claims will sound a warning before flame breaks out, operates on temperature-controlled alloy elements. The composition of these alloys is governed by the specific requirements of the plant in which the system is installed.

A fine magnetic wire carries detector elements in fuse-type bases overhead in the critical areas of the plant. These wires

On their way!... smoothly and profitably



Thermoid Conveyor Belts cut materials handling costs

Thermoid Industrial Rubber Products — Quality — Service

Thermoid Conveyor Belts provide top performance regardless of operating conditions—oil, grease, severe flexing, shock loads, high abrasion or extreme heat.

In the warehouse or on the production line, Thermoid Conveyor Belts handle materials of all kinds more efficiently and economically . . . give that extra margin of endurance that reduces maintenance and replacement costs . . . pays off in longer wear.

Write for a copy of the Thermoid Conveyor Belting Catalog No. 3679, or call your Thermoid distributor. He is prepared to suggest the best conveyor belt for your requirements.

When you have an unusual materials handling problem, a Thermoid Sales Engineer is always ready to help.

It will pay you to specify Thermoid.

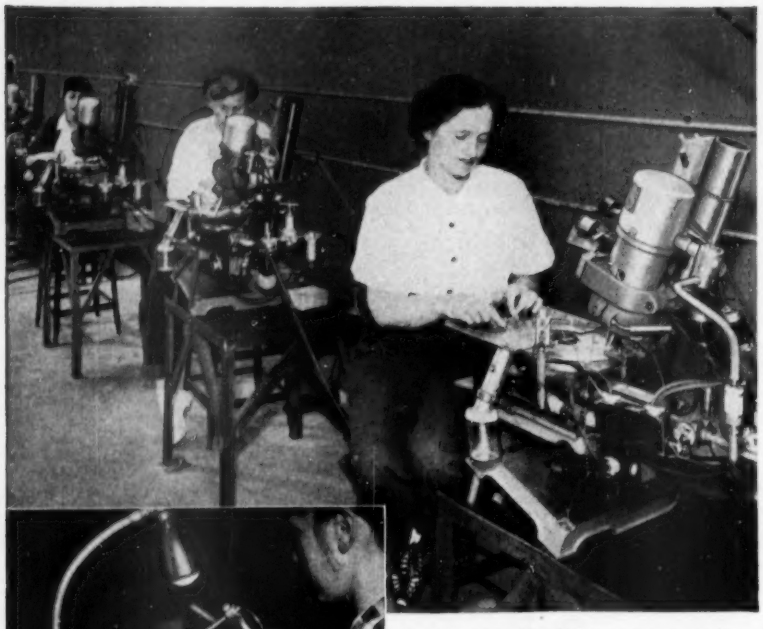
Conveyor & Elevator Belting • Transmission Belting
F.H.P. & Multiple V-Belts • Wrapped & Molded Hose

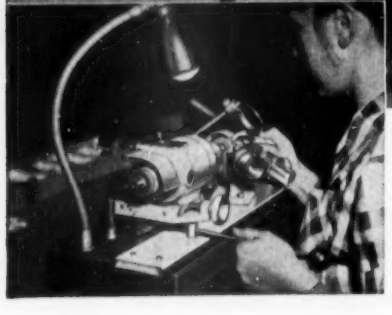
Thermoid

Rubber Sheet Packings • Molded Products
Industrial Brake Linings and Friction Materials

Thermoid Company • Offices & Factories: Trenton, N. J., Nephi, Utah

124,800 holes per day! ... using six DUMORE Automatic Drill Heads





Parts are hand loaded in an automatic indexing rotary table with 24 stations. Peak production has reached 23,000 pieces.

A Dumore Precision Drill Grinder is used to sharpen drills after a full day's production. Maximum drill life per grind has reached 23,000 holes.

Get amazing cost-reducing benefits with DUMORE tools

TALK about amazing production! One west-coast manufacturer uses six *continuous running* Dumore Automatic Drill Heads to drill tiny brass parts — at the rate of *20,800 per head per day.* The job calls for a No. 71 drill (dia. .026") and hole depth of .069". In addition to the amazingly high production, the user reports that the Dumore Automatic Drill Heads slash costs of drill breakage, down-time and scrap loss.

Amazing, too, are the results this company achieves using a Dumore Precision Drill Grinder to sharpen their drills for this job. They actually get a maximum of up to 23,000 holes per sharpening. That means a full day of continuous production for every Dumore sharpened drill, *without stopping to regrind.*

Get all the information about these tools — their capacity to increase small hole production — to eliminate operator guesswork — to provide completely automatic control. Ask your nearby industrial distributor for a demonstration, or write:

THE DUMORE COMPANY
1341 Seventeenth Street • Racine, Wisconsin

SAFETY & PLANT PROTECTION

Begins on page 206

are connected either to an alarm bell or to the local fire department box.

The system operates from 110- or 220-volt line, reduced to 24 volts that keeps the relay points open within the alarm control box. When heat disintegrates a detector, the secondary circuit breaks, allowing the relay to close and setting off the alarm 10 to 14 degrees before the flame appears.

Rexalloy Corp., 281 E. 21st St., Hialeah, Fla.

■

Tank Car Safety Platform

This platform is designed to eliminate the hazard of an employee standing and working on the curved top of railroad tank cars during loading and unloading operations.

Platform is supported on a steel column bolted upright to a concrete base alongside the railroad tracks. Grated deck of the platform is balanced and rides on roller bearings so it is easily turned by a hand crank wheel. A foot brake holds the platform stable in the stopped position. It is possible to service two cars simultaneously.

Nichols Engineering Co., 3816 W. Grand Ave., Chicago.

Turn the page

NEO-FLOW REDUCING CAMERA
An important new development for making reduced-scale photocopies of any subject . . . printed, written or drawn on any material . . . paper, vellum, cloth, etc. Reductions from 1:1 to 6:1, up to five on any one camera. *Send for free brochure.*

MAGIC HAND VACUUM BLANKET PRINTER—A totally new concept: a rubber blanket replaces conventional, heavy, rigid lid. The result is less print spoilage; faster, simpler multi-print loading; finer quality reproduction. 3 models: 38" x 50", 44" x 74" and 50" x 98". *Send for free brochure.*

F-1 PHOTOCOPY PRINTER WITH "PNEUMATIC CUSHION"
A revolutionary idea! F-1 makes photocopies of pages from books, bound records, pamphlets and other material up to 1½" thick. An air-filled plastic cushion in the lid of the photocopy printer automatically adjusts to the correct pressure for perfect contact. *Send for free brochure.*

SAVE HUNDREDS OF DRAFTING HOURS

with Modern Photocopy Methods and Equipment

Eliminate re-drawing and re-tracing of standard parts which appear on modifications . . . draftsman makes photocopy of standard parts . . . then draws only new work. Eliminate re-making tedious ink tracings on cloth . . . draftsman makes one reverse-reading photocopy on tracing cloth which acts as master copy for repeated high-quality blueprintings. These are only two highlights of modern photocopy methods and equipment.

As a leader in industrial photocopy, Peerless is unusually well qualified to help you utilize the most efficient photocopy techniques. Years of experience in designing and engineering for professionals in the photocopy field assure advanced, hi-speed photocopy equipment. A Peerless distributor skilled in the photocopy business will gladly discuss its advantages for your particular requirements. Write us for his name. He's a specialist worth knowing.

PEERLESS PHOTO PRODUCTS, INC.

Shoreham, Long Island, N.Y.

Manufacturers of quality Photocopy Papers and special-purpose Industrial Photocopy Equipment

after 5 years' service this REPUBLIC WATER HOSE comes home in a bag!!

It's a fact! Five years ago a 50-ft. length of Republic Rubber Water Hose became part of a roof-top cooling system at the Kircher Asbestos & Rubber Company, Phoenix, Arizona.

The hose lay immobile across a flat, black-topped roof, channeling waste water from the cooler to a downspout drain. It was exposed to all the elements, summer and winter. Temperatures varied from a shivery 20° to a blistering hot 150° and yet, after five full years of service, the Republic Hose **showed absolutely no visible signs of deterioration!**

So remarkable was its condition that company officials cut off a sample section of the hose, put it in a bag and returned it to us with a letter of commendation. Another example of Republic superiority . . . more proof that Republic Rubber Products are **quality-built** for every type of industrial service, and, whether it's Hose, Belting or Rubber Specialities, it pays to specify the best —**Republic Rubber Products!** Write today for full facts.

Since 1901, Republic Rubber has been the outstanding source for all types of Industrial Rubber Products. Write us today for the name of your local Republic Rubber Distributor, who can save you time and money through expert installation, application and maintenance service.

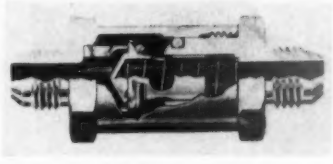
REPUBLIC RUBBER DIVISION

LEE RUBBER & TIRE CORPORATION, YOUNGSTOWN 1, OHIO

INDUSTRIAL RUBBER PRODUCTS

Begins on page 162

VALVES & FITTINGS



Flow Limiter Valves

This new valve is designed to allow flow in one direction up to a predetermined rate and shut off to prevent a higher rate, while allowing unrestricted flow in the opposite direction.

Although developed primarily as a flow limiter, the valve can also be used as an automatic drain or dump valve.

These valves are manufactured with male tube or pipe connections on the discharge side in the restricted flow direction and with either male or female connections on the inlet. Made to customers order.

James-Pond-Clark Co., 2181 E. Foothill Blvd., Pasadena 8, Calif.

■

Rotary Pressure Joint

The Anco rotary joint will carry steam under pressures up to 350 psi. and liquids up to 3500 psi.—while rotating at high speed. And it has only 14 parts.

It's available in all pipe sizes, from ¼ inch to 5 inches.

Anco, Inc., Dept. 37, One Baker St., Providence.

Turn the page

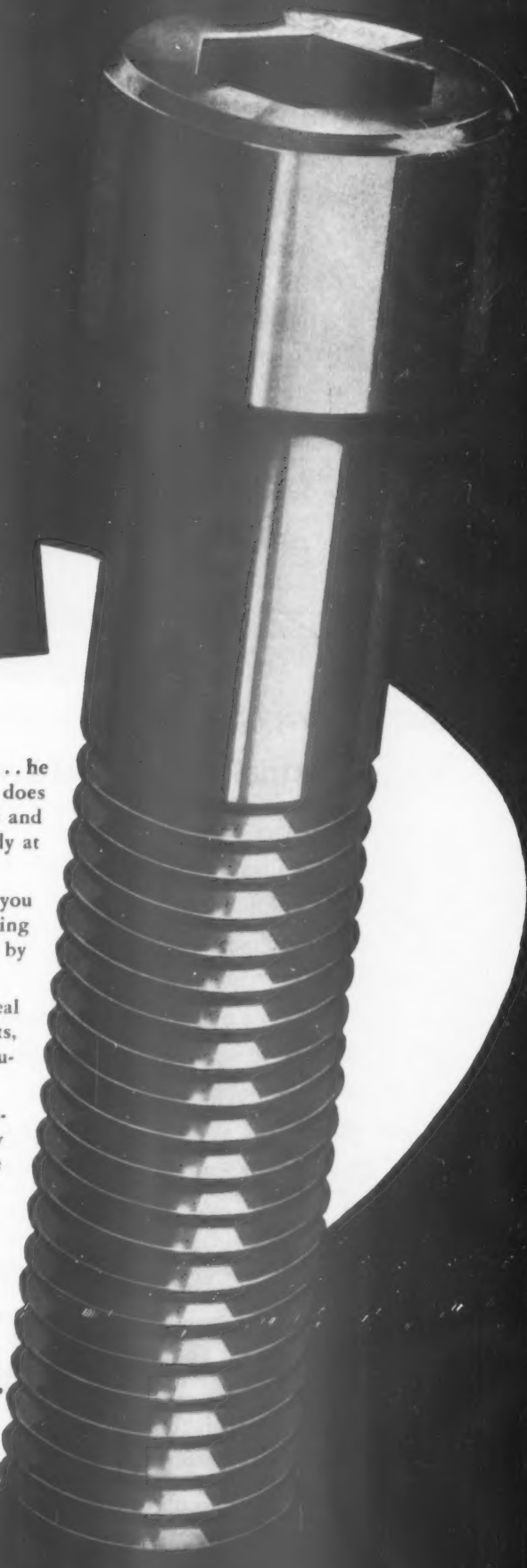
Meet your B-RIGHT-ON *dealer*

Just as you must know your customers' needs . . . he knows yours. He really understands . . . as does every Brighton franchise holder . . . the uses and applications of socket screws . . . and is ready at any time to advise you.

One of his most important functions is to give you prompt service. He's johnny-on-the-spot . . . filling your order from his adequate stock, backed up by centrally located Brighton factory stocks.

He's proud of Brighton Screws . . . they're a real quality line . . . meeting all of your requirements, including the highest standards of strength, accuracy and uniformity.

Make your Brighton dealer a member of your production team . . . get his help on *any* socket screw question. If you're not already acquainted . . . write for his name.



- Socket Set Screws
- Socket Cap Screws
- Socket Head Stripper Bolts
- Socket Pipe Plugs

THE BRIGHTON SCREW & MANUFACTURING CO.

QUALITY B-RIGHT-ON PRODUCTS ®

Reading Road opposite Deer Creek
Cincinnati 2, Ohio

with KEX wiping towels...

Because Every Square Inch is Usable—and KEX Industrial Wiping Towel Rental Service...

- Is more economical
- Supplies towels that are safe to use
- Simplifies handling
- Saves man hours
- Better equips our men
- Relieves me of shopping around
- Is a national service I can depend on
- Is available to *all* my plants

For complete information see your Classified Telephone Directory for nearest Kex distributor, or write Kex National Service, 295 Fifth Avenue, New York 16, N. Y.

"KEX" NATIONAL SERVICE

REG. U.S. PAT. OFF.

It isn't Kex unless it's imprinted with the Kex name

Begins on page 212

Pipe Hangers

You get mathematically perfect constant support for high temperature process and steam piping with Model R Grinnell constant support pipe hangers. You can permit 10% increase or decrease in load by adjusting a single bolt.

Hangers can be bolted directly to the building structure. Frames are drilled for either single- or double-rod suspension. Three regular frame sizes will handle all loads from 48 to 9304 pounds.

Grinnell Co., Inc., 260 W. Exchange St., Providence 1.

■

Rubber-Lined Pipe With Foolproof Flanges

Connecting sections of rubber-lined pipe is easy and fool-proof with the new Spacelok flanges. You don't have to worry that uneven, insufficient, or over-tightening of bolts will result in leakage or failure. In Spacelok there are cast-in spacing locks which contact the metal face of the adjoining flange.

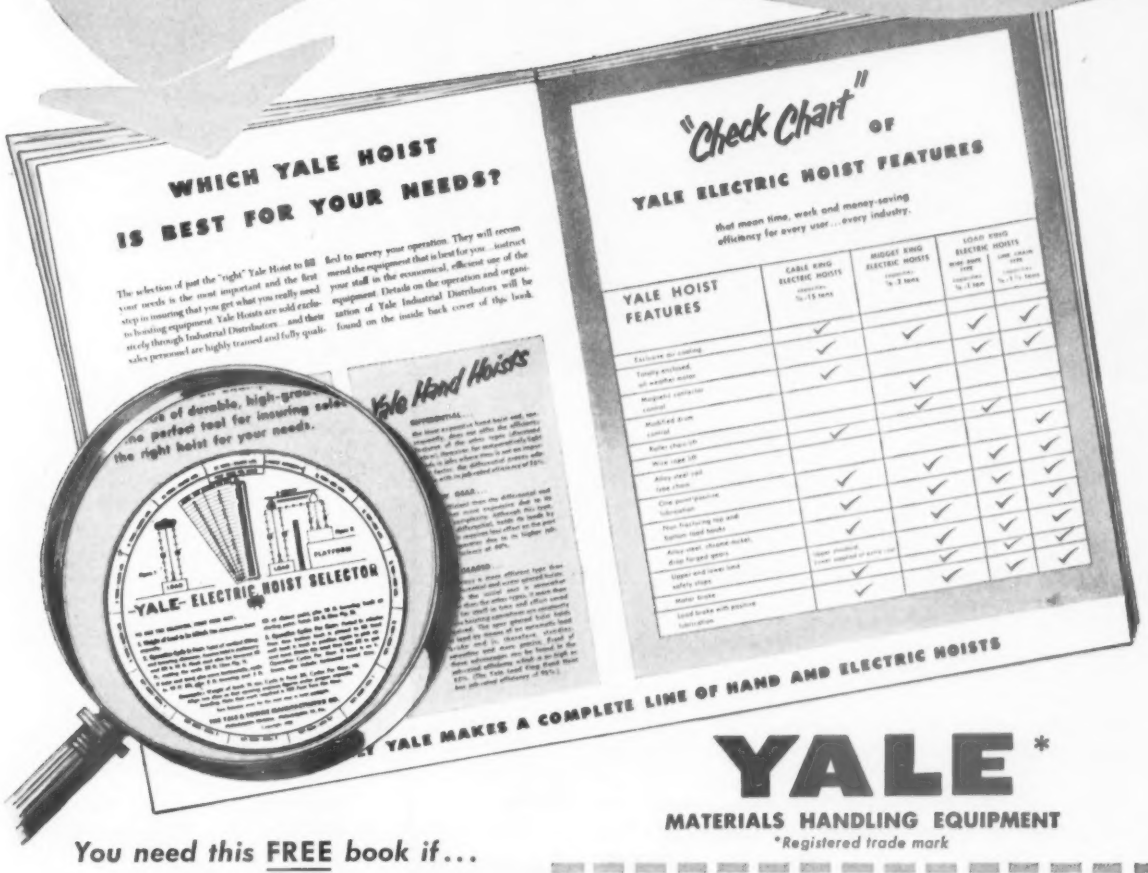
When you tighten the bolts fully, the sealing gasket and flange rubber are compressed to exactly the right degree. Neither thermal expansion nor normal physical stresses will wreck the connection. Inexperienced workmen can do the job.

Polson Rubber Co., Garrettsville, Ohio.

Turn the page

Here are just two of the big pages from the new Yale Hoist Book

IT'S YOURS FOR THE ASKING


WHICH YALE HOIST IS BEST FOR YOUR NEEDS?
"Check Chart" OF YALE ELECTRIC HOIST FEATURES
that mean time, work and money-saving efficiency for every user... every industry.
YALE HOIST FEATURES
CABLE KING ELECTRIC HOISTS
MIDGET KING ELECTRIC HOISTS
LOAD KING ELECTRIC HOISTS
Yale Hand Hoists
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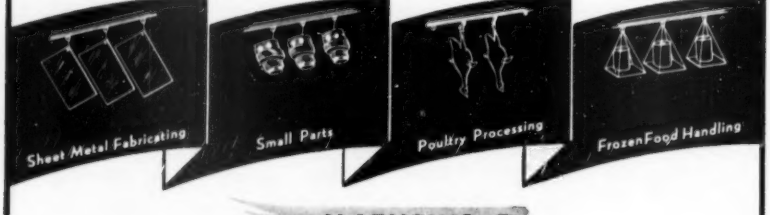
Before Buying Light Trolley Conveyers

Engineered for dependable overhead conveying, the Chainveyor, a light-duty, fully enclosed, continuous chain conveyer is indeed an oustanding performer. Extremely flexible with short radius curves and straight tubular track sections, the Chainveyor is easily installed and adaptable to unusual situations. The Chainveyor is, in fact, completely practical everywhere light overhead conveying equipment is required.

*The Chainveyor is manufactured by United States Spring and Bumper Co. of Los Angeles, Calif., and distributed nationally by Mathews Conveyer Company.

Write Today for Illustrative Bulletin No. CV-52



MATHEWS CONVEYERS

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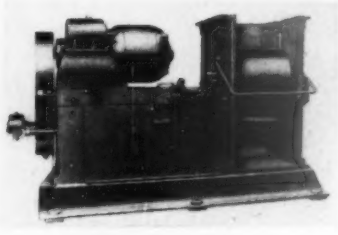
Canadian Division, Mathews Conveyer Company, Ltd. . . . . Port Hope, Ontario

Begins on page 162

MISCELLANEOUS



Scrap Bundler for Stringy Scrap

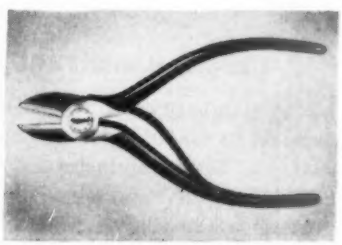
Stringy scraps of wire or strip are no problem for this scrap bundler. It will make compact cylinders of them all for easy handling, storage, shipping, and re-melting. Comes in two models.

It's recommended for use with steel, aluminum, brass, and lead. The metal comes out compressed into rolls 18 inches in diameter and 18 inches long, or 24 inches in diameter and 24 inches long, according to the model used.

Safety features include a safety-switch lever that extends across the front of the hopper and a start-stop-reverse switch that can be adjusted so that the operator must hold down a button while bundling.

McLanahan & Stone Corp., Hollidaysburg, Pa.

■



Oblique Pliers for Close Trimming

The entire length of the cutting knives on these pliers works to give you a close, clean trim.

Narrow head makes them ideal

ARO AIR TOOLS
HELP GILLETTE GET
SUPER-SPEED PRODUCTION

SCREW-DRIVING. Aro Screwdriver, Model 7329-R, in special fixture made by Gillette to hold the Super Speed Razor during assembly of handle. Foot treadle actuates throttle. Aro's torque control very important here—drives screw to just-right tightness!

GRINDING. Aro Grinder, Model 7014, used by Gillette in preparing blade stock for processing in a continuous strip, coiled on reels.

Millions of Gillette Super Speed Razors have been assembled during the past five years with the help of ARO Air Tools.

Perhaps ARO can help you speed up production and cut costs in drilling, grinding, polishing, screw driving and other operations.

An ARO Field Engineer will gladly help in engineering your job or *contact your Aro distributor.*

The Aro Equipment Corp., Bryan, Ohio
Aro Equipment of Canada, Ltd., Toronto, Ont.

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Also . . . LUBRICATING EQUIPMENT . . . HYDRAULIC EQUIPMENT . . . AIRCRAFT PRODUCTS . . . GREASE FITTINGS

cut light costs

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TRANSLUCENT FIBER GLASS PANELS

NOW YOU can use cost-free daylight wherever you want it in new or existing buildings. Simply replace any part of wall or roof with Alsynite panels. Corrugated Alsynite nests with and installs just like corrugated metal. Gives even, diffused light. Installs for less, cuts light bills and eliminates up-keep because it's shatterproof.

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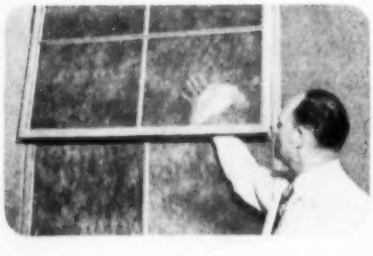
End the broken glass problem permanently by replacing glass in standard sash with shatterproof *Flat Alsynite*. Standard sizes. Easy to install. Alsynite is feather-light, can be sawed and nailed. Seven colors.



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MISCELLANEOUS EQUIPMENT

Begins on page 216

for use in confined places, and a replaceable tempered steel spring keeps pliers in open position. Called No. 210-L, they're available in 5- and 6-in. sizes.

Mathias Klein & Sons, 3200 Belmont Ave., Chicago 18.

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For Copying Records

This copy camera is designed to make photocopies of your records in 5 seconds flat—just about as fast as your operator can feed them in.

The Tupper-Peerless Copy Camera will photograph up to 720 documents or cards per hour on a roll of photocopy paper. It will snap one side of records from 8½x11 up to 8½x14 inches. It will photograph both sides of 5x8-in. file cards.

Peerless Photo Products, Inc., Shoreham, Long Island, N. Y.

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PACKAGED WATER CHILLER designed to provide a single unit-source of cold water for air conditioning and refrigeration systems requiring between 10 and 50 tons for cooling has been marketed by The Trane Co., La Crosse, Wis. The factory-assembled and tested unit requires only simple plumbing and electrical connections to install.

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Pipe Repair CLAMPS

Made for every type of leak—any temperature or pressure. Send for Catalog No. 41-O.

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STOP DUST

DUSTKOPS UNIT TYPE LOW COST — **22 Models** 300 cfm to 10,000 cfm ¼ hp to 15 hp

AVAILABLE FROM STOCK

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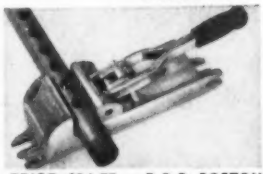

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TIME SAVER—Quick Clamping Action—Eliminates Slow Threading.

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CUTS COSTS—Portable Multi-Operation Holding Fixture.

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Specifications—Weight: 10 lbs., Length 13½", Width: 3", Jaw Height: 1⅝", Max. Jaw Opening 3¼". Machine Ground Top, Bottom & Holding Side Working Surfaces.

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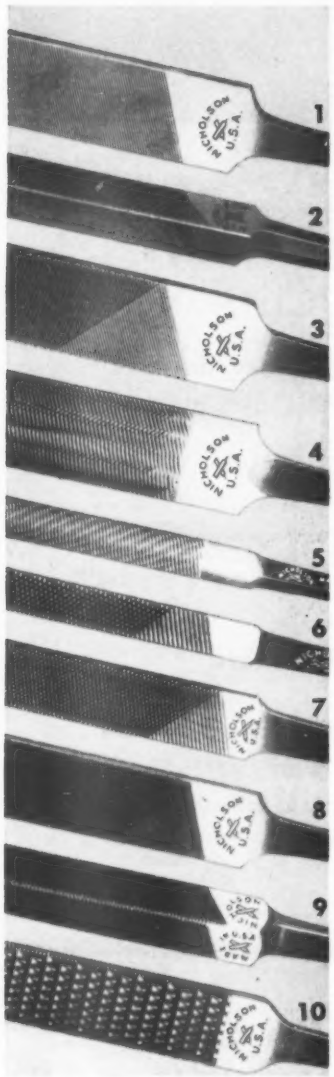
The right file for the job and Twelve perfect files in every dozen. . . . Through four generations of Nicholsons these two keynotes have been interwoven with the aims and policies of America's foremost file manufacturer. Here they have inspired every development in file engineering; guided every stage of file manufacture; spearheaded every phase of service to the industrial user. They definitely lead to better work, higher production, lower filing costs. Thousands of kinds, cuts and sizes. Examples:



⬅ REGULAR PURPOSE FILES

(1) **MILL**—for smoothing, edge sharpening, large-tooth saw filing.

(2) **TAPER**—Regular, Slim, Extra Slim, Double Extra Slim types—for sharpening hand saws.

(3) **FLAT.** (4) **HALF ROUND.** (5) **ROUND.** (6) **SQUARE.** (7) **PILLAR.** (8) **KNIFE.** (9) **THREE SQUARE.** Mostly double cut—for fast stock removal.

(10) **WOOD RASP**—Flat and Half Round types.

SPECIAL PURPOSE FILES ➡

(11) **G. P. MACHINIST'S**—a special file combining the "General Purpose" principles of both regular Mill and Flat files to give metal-removing speed with smooth finish.

(12) **SUPER-SHEAR**—a patented curved-tooth file with teeth in off-center arcs, for roughing and smoothing in one operation. Serrations break up filings.

(13) **CURVED TOOTH**—rigid tanged type for filing flat surfaces. Flexible type (with holder, not shown) for concave and convex surfaces as well as for larger flat areas.

(14) **LEAD FLOAT**—has coarse, short-angle "blade"-like teeth which shear or "float" away metal. For lead, copper and other soft materials.

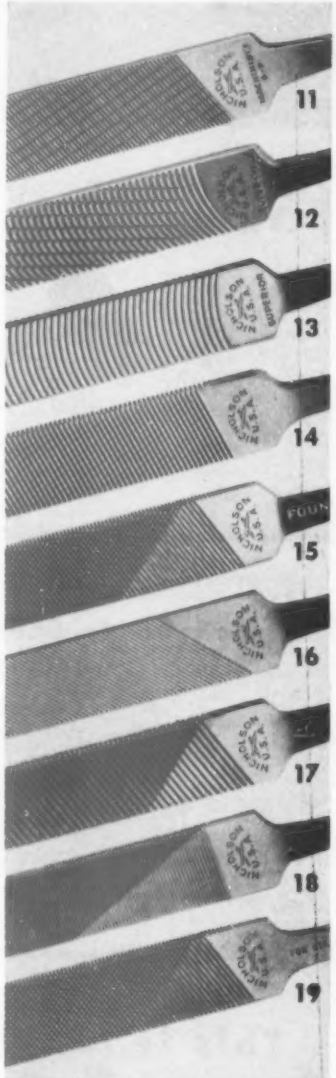
(15) **FOUNDRY**—has extra-rugged teeth to resist breaking out. For fast metal removal on castings.

(16) **LONG ANGLE LATHE**—teeth cut for chip clearing and clean shearing—for fast, smooth finishing.

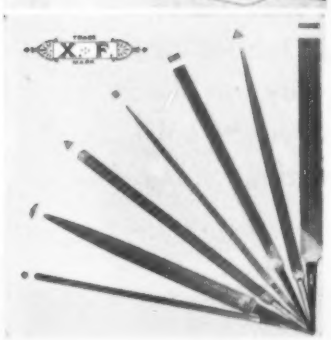
(17) **ALUMINUM TYPE "A"**—special serrated-tooth and "open-throat" cut, to prevent clogging. For aluminum and other ductile metals.

(18) **BRASS**—short-angle "upcut" teeth prevent file running off work and help keep gullets clear of chips. Long-angle "overcut" breaks up filings.

(19) **STAINLESS STEEL**—special-shape teeth to withstand high abrasive action of stainless steel's tough chromium carbides and nickel alloy.



X. F.* SWISS PATTERN FILES



Hundreds of shapes, cuts and sizes for hand and machine filing of precision tools, dies, fine instruments—all sorts of delicate and intricate pieces. Made to more exacting measurements than American Pattern files—with smaller points, longer tapers, finer cuts. **X.F.* *means Extra Fine.*

ROTARY FILES

All popular shapes and head sizes in (1) *Hand-Cut Hi-Speed Steel.* (2) *Ground Burs Hi-Speed Steel,* and (3) *Ground Burs Carbide;* in both ¼" and ⅛" shanks. Accurate cuts and peripheries, true-centered shanks —Nicholson superior quality throughout. ➡

NICHOLSON FILE COMPANY
27 Acorn St., Providence 1, R. I.
(In Canada, Port Hope, Ont.)

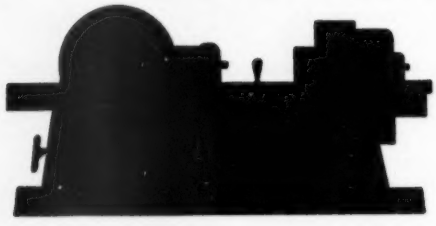
WHAT PRICE *obsolete methods of* LUBRICANT APPLICATION?

This is an OIL CAN...

It costs the prevailing Hourly Rate for an Oiler to carry it around.

The longer it is carried, the more expensive it gets.

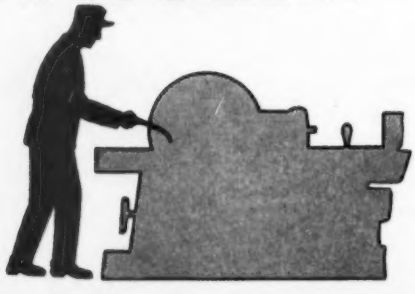
This is a MACHINE...



It costs Thousands of Dollars.

Approximately 60 Bearing Points must be individually contacted—most of which are difficult to locate and reach.

This is an OILER...



Regardless of his capability he cannot be expected to apply the right lubricant—in the right quantity—at the right time intervals to each and every bearing.

Lincoln Centralized LUBRICATION SYSTEMS Control LUBRICANT APPLICATION Automatically

BY APPLYING the RIGHT LUBRICANT in the RIGHT QUANTITY at the RIGHT TIME

Lincoln *Centralized* **SYSTEMS** *for* **CONTROLLING LUBRICANT APPLICATION CONVERT** *Preventive Maintenance to* **PRODUCTIVE MAINTENANCE**

These are the BENEFITS...

1. Lubricates all bearings on the machine in 45 seconds while machine is operating.
2. Increases productive rate and efficiency of machine to a uniform maximum.
3. Increases bearing-life 1500% or more.
4. Prevents waste and contamination of oil.
5. Assures a predetermined, measured injection of oil or grease to each bearing.
6. Improves product quality... reduces spoilage.
7. Reduces power consumption up to 40%.
8. Eliminates personal injuries attributable to oiling, with corresponding reduction in compensation costs.

These National Concerns...

and many more, are profiting by Controlling Lubricant Application with Lincoln Centralized Systems:

- Alexander Smith, Inc. Yonkers, N. Y.
- Battle Creek Bread Wrapping Co. Battle Creek, Mich.
- Cudahy Brothers, Cudahy, Wis.
- Detroit Gear Division, Borg-Warner Corp.
- General Electric Co., Schenectady, N. Y.
- Hanna Coal Co. Div. Pittsburgh Consolidated Coal
- Joy Manufacturing Co., Pittsburgh, Pennsylvania
- Norge Division, Borge-Warner Corp.
- Owens-Corning Fiberglas Corp. Ashton, R. I.
- Spicer Manufacturing Division of Dana Corp.

Here are some of the RESULTS...

- A Metal-Working Plant... saved annually, $72,000 in labor and materials, and increased production $816,000.
- A Textile Mill... saved annually, $1,742 per machine, 90% in labor, 30% in lubricants, and reduced spoilage 25%.
- A Coal Preparation Plant... saved annually, $32,240 in labor, and 45% in lubricants, and gained unestimated thousands of dollars in production.
- A Food Processing Plant... saved annually, 50% in lubricants, and added a full hour and a half of production per machine, per day.

Here's how to find out more about Lincoln Systems...

Write for your copy of Lincoln's new catalog No. 80 with complete specifications on 22 types of Systems to meet all requirements.

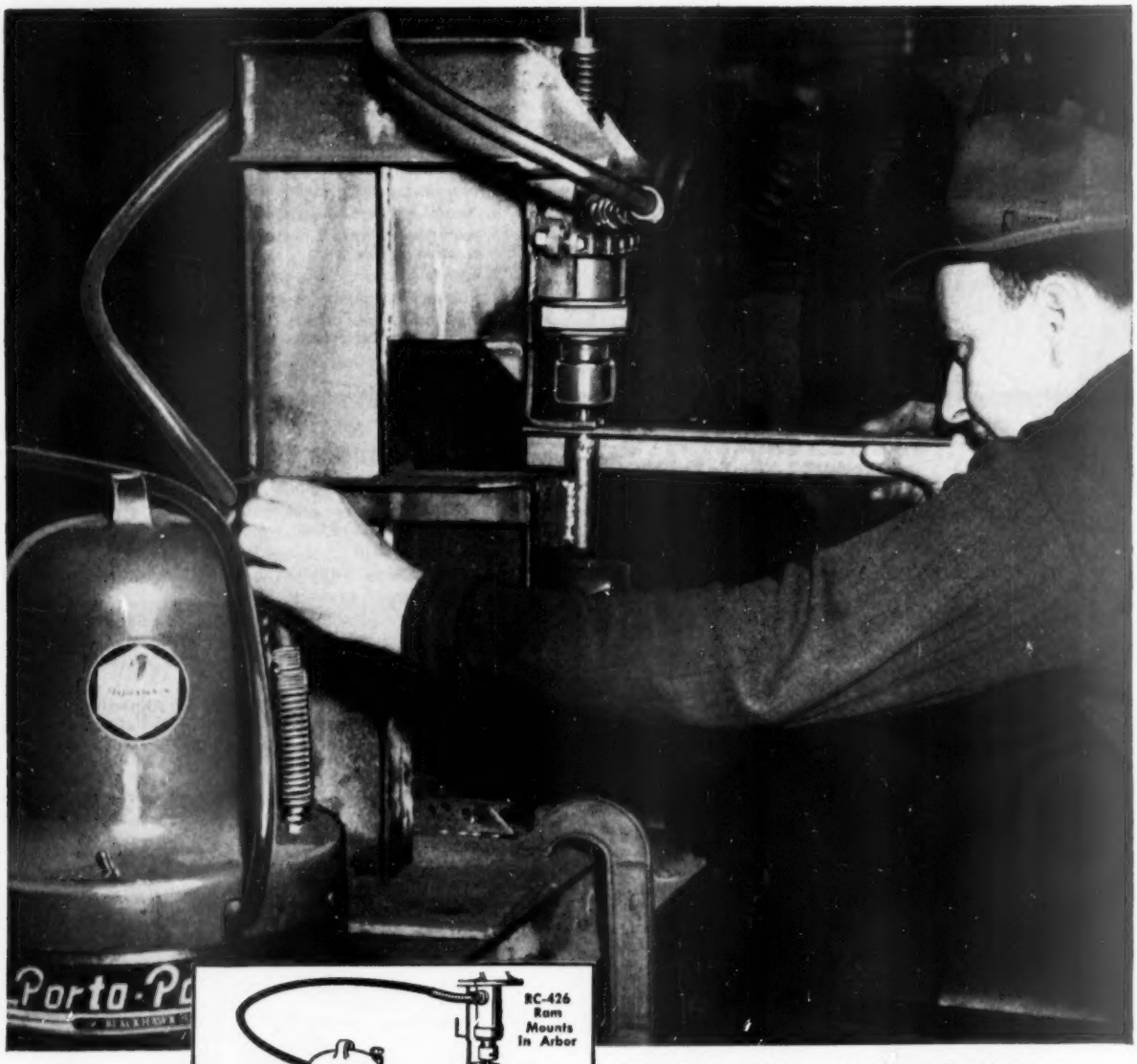
Nation-wide distribution in all major markets

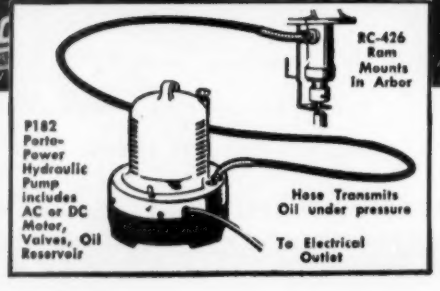
...Available through leading Industrial Distributors, coast-to-coast:

...15 sales and service offices in principal cities.

LINCOLN ENGINEERING COMPANY, 5731 Natural Bridge Ave., St. Louis 20, Mo.

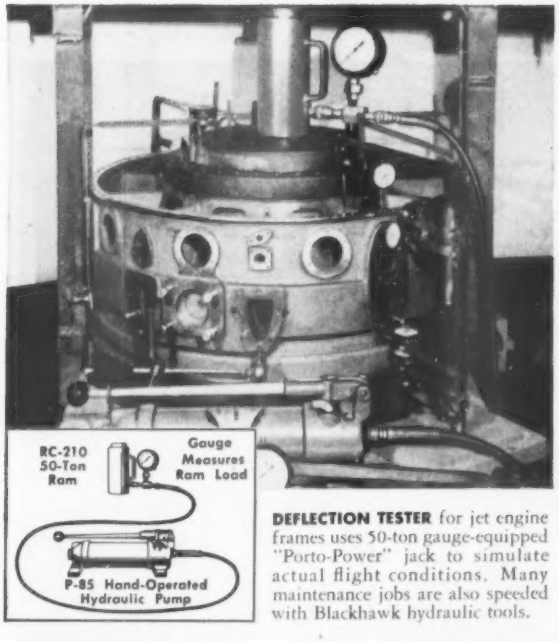
With IDEAS like these and hand tools




RC-426 Ram Mounts In Arbor
P182 Porto-Power Hydraulic Pump includes AC or DC Motor, Valves, Oil Reservoir
Hose Transmits Oil under pressure
To Electrical Outlet

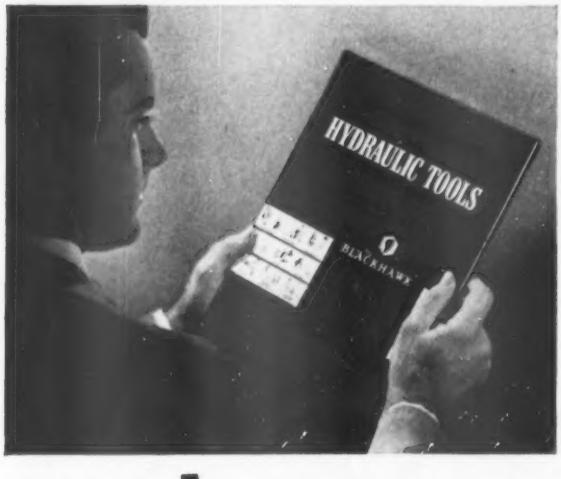
THIS SHOP-BUILT PUNCH PRESS was made with inexpensive, standard "Porto-Power" hydraulic components to meet a special production problem. The 10-ton hollow push-pull ram, with its power-driven pump, pierces 12 holes per minute in ½ in. angle iron.

.... hydraulic tools multiply manpower!



DEFLECTION TESTER for jet engine frames uses 50-ton gauge-equipped "Porto-Power" jack to simulate actual flight conditions. Many maintenance jobs are also speeded with Blackhawk hydraulic tools.

UNIFORM STUD TIGHTENING is assured with "Tork-flash" tension wrench. No guesswork on this assembly line! Other hand tools in broadened Blackhawk line offer similar gains in time, accuracy.



Ideas like these win CASH AWARDS —and save time, money, materials

Many industrial methods today are being revolutionized by *ideas** which utilize Blackhawk equipment. To encourage exchange of more such ideas for the good of industry, Blackhawk offers *cash awards each quarter.* Recognized are the best ideas on how to save time, save materials, prevent accidents or solve special problems with Blackhawk Hydraulic Tools or Blackhawk Hand Tools. Here are winners for the quarter ending Dec. 31, 1952:

FIRST GRAND AWARD
Wesley W. Gunkel, Ass't. Prof.
New York State College
of Agriculture
Cornell University, Ithaca, N. Y.

SECOND GRAND AWARD
Sim C. Schaefer
Automotive Sales and Service, Inc.
154 S. Main St., Fond du Lac, Wis.

THIRD GRAND AWARD
J. E.Williams
Box 1001, Duncan, Okla.

FIRST HONORARY AWARD
Gerald Leonardy
2283 LaSalle Gdns. S., Detroit

SECOND HONORARY AWARD
Robert Rhoads, Master Mechanic
Reading Bus Co., Reading, Pa.

HEADQUARTERS FOR THE WORLD'S MOST COMPLETE LINE OF HYDRAULIC TOOLS ... plus INDUSTRIAL HAND TOOLS

BLACKHAWK

**Get the famous 64-page Blackhawk IDEA BOOK. (It tells how you too can win cash awards.) Ask your Industrial Distributor for a free copy or write Blackhawk Mfg. Co., Dept. M-2733, Milwaukee 1, Wisconsin.*

STARTLING FACTS reveal really pays off

that Preventive Maintenance on V-Belt Drives

What is the *real* cost of replacing a set of V-Belts on a machine? Often it is far more than just the cost of the belts.

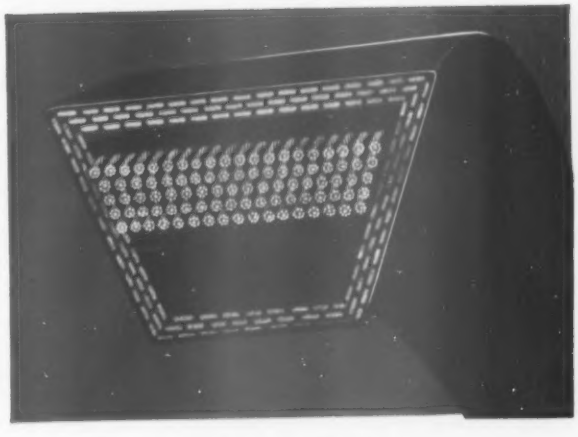
For example, a New Jersey plant has V-Belt drives on 25 air compressors. Each drive consists of three belts, and the belt life averages 2½ years. Just look at the breakdown of costs when a compressor has to be shut down for a belt change:

Cost of new belts	$ 6.03
Cost of installation labor	2.00
Cost of lost production during down time	500.00
Total cost of belt change	$508.03

Since this company operates 25 such air compressors, the total cost of changing V-Belts could reach $12,700.75 every 2½ years, or $5,080.25 per year.

On installations such as this, Preventive Maintenance on V-Belt drives really pays off. Dayton V-Belt Survey Experts often can extend the time period between belt changes by 50 per cent—through installing Dayton V-Belts. In this New Jersey plant, for instance, it would be possible to extend the time between changes to 3¾ years. This, in itself, is a worth-while saving. But the real pay off comes from the elimination of costly down time through Dayton's Preventive Maintenance Program.

You too will have drives where the overall cost of replacing belts is high. Consider the savings Dayton V-Belts and Preventive Maintenance offer you. Call your Dayton Jobber for further details, or write Dayton Rubber Company, Dayton 1, Ohio.



THOROBRED V-BELT

The Dayton Thorobred V-Belt is specially designed and built to transmit maximum horsepower where normal V-Belt service is involved. To impart high tensile strength and maintain great flexibility, the belt is constructed with continuous filament, high tenacity Rayon Cords whose surfaces are fully rubber coated by Dayton's new Thoro-Bonding process. To seal the inner structure, the belt is encased in a costly, all-weather "Hi-Twist" fabric cover impregnated with special rubber compounds for longer wear.

See "Belting" in the yellow pages of your local telephone directory for the name of your Dayton V-Belt Distributor. Let him cut costs on your V-Belt drives!

© D.R. 1953

Dayton Rubber

Since 1905

World's Largest Manufacturer of V-Belts

DAYTON RUBBER COMPANY • DAYTON 1, OHIO

SIGNIFICANT DEVELOPMENTS IN PRACTICAL LABOR RELATIONS

TOLD IN BRIEF FOR BUSY FACTORY EXECUTIVES

By **PAUL A. KING**, *Attorney, Bigelow-Sanford Carpet Company, Inc. Member, New York Bar.*

COMPANY DISCRIMINATES AGAINST "OLD" EMPLOYEE OF 38. *Massachusetts arbitrator rules against company that applies age qualification inconsistently* . . . . . **Page 226**

THE PENDULUM SWUNG—AND GOT STUCK. *NLRB Chairman dissents on Board ruling that union must always have last word before election* . . . . . **Page 232**

WHO'S A BOSS? *U. S. Court of Appeals rules that existence of supervisory power is true tes.* . . . . . **Page 226**

STRIKING WORKERS GET VACATION PAY. *N. J. Court of Appeals gives strikers vacation pay based on time actually worked before strike* . . . . . **Page 230**

HOW TO GET RID OF A UNION EMPLOYEE. *NLRB disagrees with union claim that driver guilty of safety violations was fired for union activities* . . . . . **Page 228**

SQUELCH NATURAL LEADERSHIP. *If an employee acts as leadman in his group, you may have to pay him for the service, even though it's unauthorized* . . . . . **Page 234**

MORE RESPECT FOR OLD AGE. *Ford union asks for cost-of-living increases, and other benefits, in pensions* . . . . **Page 232**

TOOL AND DIE WORKERS AS A BARGAINING UNIT. *New NLRB policy allows special unit only if skills of employees involved are not duplicated elsewhere in plant* . . . . . **Page 230**

BRIEF—BUT IMPORTANT. *Utah requires men who accept employment in a struck plant to register . . . Net assets of CIO have gone up . . . Pontiac, Mich., joins list of cities banning racial and religious discrimination in employment . . . Taft-Hartley doesn't compel a union to give financial report to its members . . . Company cafeterias do not always come under price control regulations . . . You do not need WSB approval to increase your pension contributions . . . NLRB rules on mines on Indian land.* **Page 236**

Company Discriminates Against "Old" Employee

The federal government—and several states—have been kicking up a fuss about industry's discrimination against older employees.

Now comes the first of published arbitration awards on the subject.

The California Electric Power Co. had a vacancy, and a 38-year-old lineman bid for it. So did a younger fellow—with less seniority. You guessed it: The younger fellow was chosen.

The Power Co. pointed to an ability-qualification clause in the contract to support its action.

Ability and qualifications being equal, then seniority controlled. The senior man said the company, was too old and had a poor health record.

The arbitrator ruled for the senior. Reasons: There was no age limitation in the contract. Other men of the same age or older had been given this job.

Moral: If age is a legitimate reason for job qualification, be consistent in the application of the rule. And if you can, negotiate an age limitation into the contract.

Who's a Boss?

A lot of employers may have gotten the idea that they can keep an employee out of a bargaining unit simply by calling him a supervisor. This won't work. On the

Conserve Manpower with Completely Mechanized Scrubbing

New SELF-POWERED SCRUBBER-VAC

Cleans Vast-Area Floors "By the Mile"

Freedom of range and *four-in-one performance* combine to give this *Gasoline-Powered Combination Scrubber-Vac* its exceptional cleaning capacity. Operating independent of power lines, the machine is free to go wherever the operator guides it . . . working in and out of production areas with ease . . . *scrubbing continuously . . . actually cleaning floors by the mile!* And this single unit — *Finnell's 218G* at left — applies the cleanser, scrubs, rinses if required, and damp-dries the floor — *all in one operation.* Thus it is capable of cleaning up to 16,000 sq. ft. per hour!

Self-starting engine eliminates rope-pulling as a means of starting. The *218G* starts quickly and easily by pressing the starter button. Operator will shut off rather than idle the machine, and thereby prevent carbonizing, a cause of engine trouble. All working parts of the *218G* are operated by *one* engine (2 cyl., 4 cycle, 9.4 hp., air-cooled). And there are no switches to set for *fast* or *slow* — slight pressure of the hand on clutch lever adjusts speed to desired rate (up to 136 ft. per minute). Two 18-inch brushes give a 36-inch scrubbing surface. The powerful vac performs quietly. Gasoline only is used for fuel (no mixing required).

Whatever the area of your floors, find out what *you* would save with a *Combination Scrubber-Vac. Finnell* makes a full range of sizes, including *electric* as well as *gasoline* models . . . available on lease or purchase plan. It's also good to know *there's a Finnell man nearby* to help train your maintenance operators in the proper use of *Finnell Equipment* and to make periodic check-ups. For demonstration, consultation, or literature, phone or write nearest *Finnell Branch* or Finnell System, Inc., 2503 East St., Elkhart, Ind. Branch Offices in all principal cities of the United States and Canada.

FINNELL SYSTEM, INC.

Originators of Power Scrubbing and Polishing Machines

50th Anniversary — Everything FINNELL for Floor Care

BRANCHES IN ALL PRINCIPAL CITIES

HOW WOULD YOU MOVE THIS PILE OF PARTS?

it's as costly as this

OR . . .

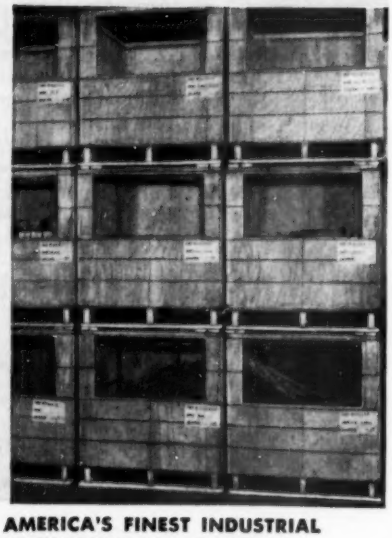
as efficient as this

Generalift

PALLET BOXES

Better check today on this versatile, popular container. The Generalift Pallet Box and fork lift truck is a combination that will substantially reduce *your* materials handling costs! Picture at right shows how many manufacturers are also using Generalift Pallet Boxes for the more economical storage of parts and materials.

Write for your free copy of "The General Box." It illustrates and describes how manufacturers are cutting container costs.



AMERICA'S FINEST INDUSTRIAL PACKAGING LABORATORY

It is here where more efficient containers are born. We will be glad to study your problem and design a container that best meets your specific needs. Write for complete details.

General BOX COMPANY

GENERAL OFFICES: 1807 Miner St., Des Plaines, Ill.

DISTRICT OFFICES AND FACTORIES: Cincinnati, Denville, N. J., Detroit, East St. Louis, Kansas City, Louisville, Milwaukee, Sheboygan, Winchendon. General Box Company of Mississippi, Meridian, Miss. Continental Box Company, Inc. Houston, Dallas

ENGINEERED SHIPPING CONTAINERS FOR EVERY SHIPPING NEED

• Wirebound Crates and Boxes • Generalift Pallet Boxes • Generalite Beverage Cases
• Cleated Corrugated and Watkins-Type Boxes • All-Bound Boxes • Corrugated Boxes

PRACTICAL LABOR RELATIONS

Begins on page 226

other hand, the National Labor Relations Board test (does the fellow exercise supervisory authority?) won't always work, either.

In a recent decision the U.S. Court of Appeals advises the NLRB that *existence* of supervisory power is the true test. Thus, a "supervisor" is not deprived of his status if for a while he is not able to exercise his power. But, if, for example, he is permanently demoted to production work, it becomes a different matter. *(Leland-Gifford)*

How to Get Rid of a Union Employee

Sometimes a supervisor will have it "in" for one of his workers because he doesn't care for his union activities. However, knowing that he can't be fired for such a reason, he'll find some other excuse. Odds are, this discharge will not be upheld by the National Labor Relations Board.

However, according to a case recently decided by the Board, if the supervisor has a real reason other than union activities, the discharge might stick.

In this latest case, a long-distance truck driver had committed 10 serious violations of safety regulations. The supervisor also made no bones about being annoyed by the driver's union activities. The worker was fired for his rules infractions.

The NLRB upheld the discharge. Said it could have been that the employee would have been fired for his bad record anyhow, irrespective of his union activities. Nor was it sure that the supervisor would have fired the worker for his union activities. *(Texas Consolidated)*

Turn the page

1953 Headquarters for

LOW VOLTAGE CIRCUIT BREAKERS

is your

TRUMBULL (T) DISTRIBUTOR

Superior design and construction features enabled Trumbull to develop circuit breakers that withstand the moisture, high-shock, and vibration of shipboard service required by the U. S. Navy. These same basic features enable your Trumbull Distributor to meet your *specific* needs from Trumbull's *complete* line.

Trumbull Circuit Breakers for load centers, panelboards, switchboards, for industrial, commercial and residential applications, provide greater safety to operators, better circuit protection against both shorts and sustained overloads. They pay off in convenience, permanence and fast restoration of service.

Available in ratings from 10 to 600 amperes and voltages up to 600 volt AC, 250 volt DC, either open type or with surface or flush-mounted enclosures, of semi-dust-tight, water- and dust-tight design. Accessories available for conversion to non-automatic, remote tripping, bell alarm and other special requirements.

Trumbull Circuit Breakers and breaker-equipped load centers, panelboards and switchboards, plus the advice of qualified Trumbull sales engineers, are available through leading Distributors everywhere. Write direct for literature or technical information.

Trumbull AT enclosed circuit breakers feature "trigger" trip, automatic tripping, silver-alloy contacts, individual calibration. 2- and 3-pole construction, from 15 to 600 amperes, 125 to 600 volt AC or 125 to 250 volt DC. Single pole available in 50-ampere frame size breakers, 125 volt AC or DC.

Trumbull TQL (plug-in) and TQ Circuit Breakers feature *both* thermal and magnetic protection, "trigger-type" quick-make and break, trip-free operation, trip-indicating handle, silver-plated contacts, arc-quenching chamber. Individually calibrated and sealed in compact, dead front phenolic cases. Ratings: 10 to 50 amperes, 120 volt AC, single pole.

TYPE TQL TYPE TQ

Trumbull K-173 Marine Hi-Shock Circuit Breakers, 3-pole, 125 volt AC or DC, 50 ampere frame size. Suitable for protection of lighting mains, feeder circuits, single load circuits supplying motors, radar, sonar, etc.

TRUMBULL (T) ELECTRIC

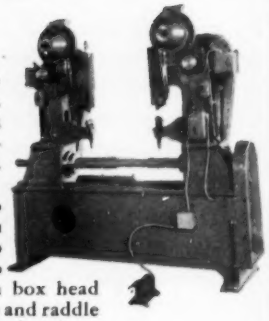
DEPARTMENT OF GENERAL ELECTRIC COMPANY
PLAINVILLE, CONN.

Speed Production.. Automatically with

T-J

RIVITORS

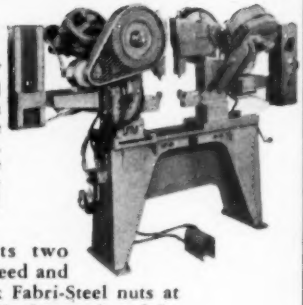
T-J RIVITOR used for automotive clutch plate assembly. Saves time and labor doing a four-fold job—assembling, setting, inspecting and ejecting.



DOUBLE RIVITOR sets two rivets at a time! Equipped with 10″ hoppers, and tooled to automatically feed and set two ¼″ diam. x ⅝″ long wagon box head rivets at a time in elevator chain and raddle or elevator flight assemblies for farm implements. Controlled by one foot pedal.

CLINCHORS

T-J CLINCHOR . . one of six special 8″ throat Underfeed Clinchors used by a large automotive body manufacturer. Feeds and sets $^{11}/_{16}$″ square cased nuts in outside quarter panels, left and right hand.



DOUBLE CLINCHOR sets two nuts at once! Tooled to feed and set ⅜″ x ⅛″ x $^{1}/_{16}$″ thick Fabri-Steel nuts at each operation. Both Clinchors tripped by same foot-operated valve. Adaptable to wide range of clinch nut setting problems.

Boost production . . . save labor with T-J Rivitors and Clinchors for many assembly jobs today . . . in aircraft, automotive, farm machinery, stampings of all kinds.

T-J CLINCHORS set clinch nuts 3 to 5 times faster! Fully automatic . . . controlled by a single foot pedal! Available in Underfeed and Gravity feed models, throat depths 8″ to 36″.

T-J RIVITORS automatically feed and set solid rivets . . . with high production! Electrically-powered Rivitor sets $^{1}/_{16}$″ to ¼″ diam. solid steel rivets up to ⅞″ long. Air-powered Rivitor sets aluminum alloy rivets up to ¼″ diam. or steel rivets up to ⅛″ diam. and up to ¾″ long. Throat depths 8″ to 36″.

Write for Clinchor bulletin 847; Rivitor bulletins 646 and 847. The Tomkins-Johnson Co., Jackson, Mich.

37 YEARS EXPERIENCE T-J

TOMKINS-JOHNSON

RIVITORS AIR AND HYDRAULIC CYLINDERS CUTTERS CLINCHORS

PRACTICAL LABOR RELATIONS

Begins on page 226

Tool and Die Workers as a Bargaining Unit

The National Labor Relations Board used to let you have a plantwide bargaining unit and a separate unit for a tool and die room—or machine shop. That's over.

Under a new NLRB policy, a special departmental unit of this sort will be allowed only if the skills of the employees in the group are not duplicated elsewhere in the plant. If there are employees outside the department with comparable skills, then the highly skilled fellows can be a separate unit. The others will belong to the plant-wide unit.

This policy was followed in the Westinghouse case where all tool and die makers from a tool and die room, model makers from a model-making shop, and a die-mold maker from a die casting shop were put into a single voting unit.

Striking Workers Get Vacation Pay

Workers out on strike at vacation time are entitled to vacation pay, says an N.J. Court of Appeals. They are entitled to it even though the union contract upon which it was based expired a month before the period of eligibility.

The employer put up these two arguments: (1) A strike breaks the employment relationship; and (2) a termination of the contract terminates the right to vacation pay.

The court said *no* to both. However, it awarded a vacation based on 11-months work and excluded the period of the strike. *(Textile Workers)*

Turn the page

Are You Putting Up This Sign Too Often?

Putting this sign up *just once* is too often.

Most of the time it means a costly shut-down, idle workmen, delayed production, very often caused by the failure of such a low-cost, but extremely vital item as portable cords. U. S. Rubber scientists have engineered U. S. Royal Portable Cords and Cables to give the longest possible life and durability. The flexible conductors are insulated with a high-grade rubber compound, and the conductor assembly is protected by 60% Neoprene jacket vulcanized in lead — thereby assuring maximum density and ruggedness. Rubber fillers are used in all portable cables, and also in the larger sizes of the portable cords. In all cases, the Neoprene jacket is reinforced internally with a strong fibrous braid.

U. S. Royal Portable Cords and Cables have extra efficiency and strength that make them ideal for use on portable electric machinery, tools, lamps, electric sanders and polishers, railroad equipment, and wherever a tough flexible cord is required.

Remember that United States Rubber Company is the only manufacturer of electrical wire and cable to grow its own natural rubber and make its own synthetic rubber and plastics. That's why "U. S." gives you a quality controlled product. Write to address below for your free copy of our general catalog on electrical wires and cables.

UNITED STATES RUBBER COMPANY

U.S.RUBBER
SERVING THROUGH SCIENCE

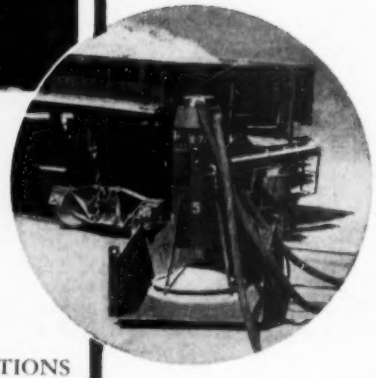
Electrical Wire and Cable Department

Rockefeller Center · New York 20, New York

VACU-VEYOR

The conveyor that reaches anywhere

Vacu-Veyor moves into tough, tight spots to unload sand, grain, chemicals or any granular material. It provides pneumatic transport of material where only buckets and shovels could otherwise be used. In unloading tanks, bins, trucks, railroad cars and ships, one man can move up to 25,000 pounds of material per hour.



A FLEXIBLE VACUUM-PNEUMATIC SYSTEM

Vacu-Veyor uses a vacuum pickup nozzle and a flexible 3-inch hose to carry material to the unloader. If desired, a pressure hose can be used for discharge. The Vacu-Veyor can convey material as far as 100 to 200 feet horizontally and as high as 65 to 100 feet above its source.

TYPICAL LABOR SAVING APPLICATIONS

Removal of sand from sand blasted ship fuel tanks is one of the widely successful applications of the Vacu-Veyor. In a typical case, it used to be necessary to have 8 to 20 men shovel thousands of pounds of sand and remove it by "bucket brigade." Now, two men with a Vacu-Veyor remove this sand at a saving in labor cost sufficient to pay for the machine in a month.

Another practical application of the Vacu-Veyor is the moving of sand and other material from trucks into high feed hoppers.

VACU-BLAST CO. INC.

Please send specific detail information applying to the _____ *business.*

Firm _____

Address _____

Signed _____

Write for free booklet

PRACTICAL LABOR RELATIONS

Begins on page 226

More Respect for Old Age

The decrease in amount of pensions under the Ford-type plan ($125 per month less social security) when social security was upped last year has teed off a lot of griping among Ford pensioners. Result: They've added their voice to the union's cry for a better pension deal.

When last heard from the Ford union was asking for an increase in pension from $125 to $200 per month (including social security), plus these major improvements:

1. Give pensioners cost-of-living increases.
2. Give disabled workers the same pension, regardless of age and seniority.
3. Give those who quit before retirement a proportionate share of their pension.
4. Give pensioners company-paid hospitalization.

What happens to these demands depends on whether Ford is made to re-open its 5-year pension contract before its expiration date in 1955.

The Pendelum Swung—and Got Stuck

When the National Labor Relations Act became law back in 1935, the union was a beat-up, down-trodden institution ignored by most employers. The NLRA was passed to equalize bargaining power between employer and employee, give recognition to unions.

But now it often looks to Board Chairman Herzog as if it's the employer who needs the equalizing and recognition.

It's been a usual Board rule that an employer who uses company time to discuss unionism with his employees must give the union

185 Stock Pumps

that make precise selection easy

FOR HYDRAULIC SERVICE, COOLANT, LUBRICATION, AND MISC. INDUSTRIAL USES

Knowledge of the complete line of Brown & Sharpe Pumps can be a valuable asset to you. It will save you time and money on many design jobs calling for smooth, quiet pump operation . . . and extended pump life without maintenance troubles. Most often, you'll find just the pump you need among the 185 stock models . . . centrifugal, geared, reversing vane . . . direct or motor-driven. If a special pump is required, however, you can depend on Brown & Sharpe engineers to design it to meet your requirements.

Complete, illustrated information on each type and size is available in the big Brown & Sharpe Pump Catalog. It includes all data, installation dimensions, and charts showing performance characteristics. Write for your copy. Brown & Sharpe Mfg. Co., Providence 1, R. I., U.S.A.

WE URGE BUYING THROUGH THE DISTRIBUTOR

Brown & Sharpe B·S

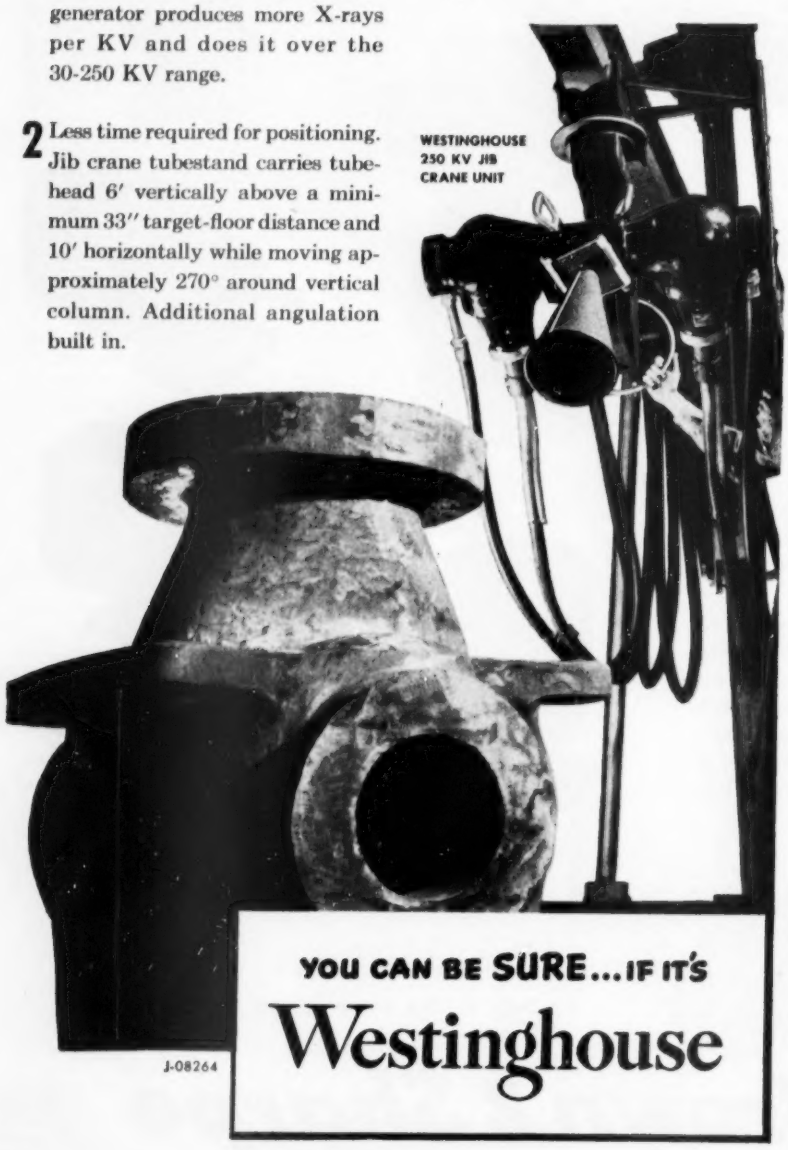
TOUGH JOBS *made easy*

At American Steel Foundries' plant in Newark, New Jersey, inspection of heavy steel castings is made easy by Westinghouse Industrial X-ray equipment. Reason: extreme *flexibility*.

1 Thick *or* thin materials take less time to radiograph. Westinghouse *Constant Potential* high voltage generator produces more X-rays per KV and does it over the 30-250 KV range.

2 Less time required for positioning. Jib crane tubestand carries tubehead 6′ vertically above a minimum 33″ target-floor distance and 10′ horizontally while moving approximately 270° around vertical column. Additional angulation built in.

Westinghouse assures you the finest, most flexible X-ray tools for your inspection jobs *plus* a coast-to-coast staff of technical experts. Call your Westinghouse X-ray representative or write Westinghouse Electric Corporation, 2519 Wilkens Avenue, Baltimore 3, Maryland.



WESTINGHOUSE 250 KV JIB CRANE UNIT

J-08264

YOU CAN BE SURE...IF IT'S

Westinghouse

PRACTICAL LABOR RELATIONS

Begins on page 226

an equal opportunity on company time. To refuse it is an unfair labor practice.

In this case Chairman Herzog felt that the union needed the opportunity about as much as a pekinese needs a saddle.

On the day of an election the union had a sound truck outside the plant during lunch hour.

Moreover, the union had handed out matchbooks and handbills (on the employer's time) and had visited employees at home.

The majority of the Board overruled the employer's argument that this equalized things, ordered him to offer the union a chance to talk on company time.

Chairman Herzog dissented.

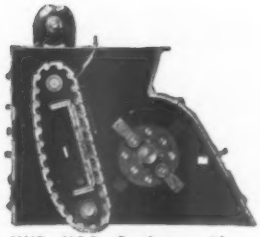
When to Squelch Natural Leadership

It often happens that one member of a work gang will assume leadership of the men. And the boss will innocently yield to it. After awhile the self-appointed leadman will claim leadman's pay, then the employer balks. The matter may go to arbitration—and this is likely to be the practical result:

1. The arbitrator will rule that as long as the employer accepts the leadman's self-appointed services, he must pay for them as such.
2. If he doesn't want the services, he'd better tell the fellow so.
3. Even after telling him of his disinterest, an employer may be stuck for the extra pay if he continues to accept the services.

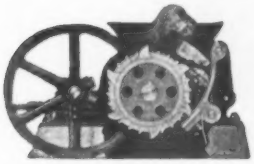
The Bethlehem Steel Co. was recently ordered to pay leadman pay until such time as the employee was advised that he was not authorized or required to act as leadman.

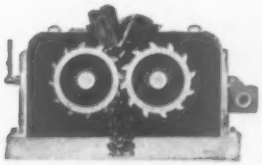
Turn the page

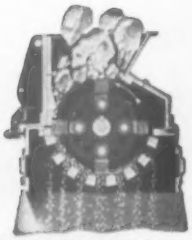


MUD HOG Crushers with traveling breaker plate

Single Roll, Double Roll and FLEXROLL Crushers







MIRACLE HAMMER Crushers for large capacities — large feed

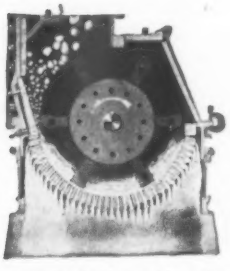
HIGH CAPACITY UNIFORM REDUCTION

A Complete Line of crushers, pulverizers, shredders for reducing all classes of material to desired size. Several types are shown.

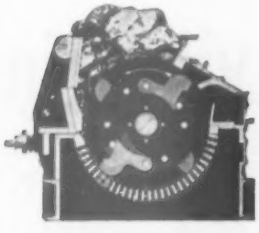
Built for specific applications — in a wide range of sizes — some with metal catchers — to suit capacity requirements.

Our modern test laboratory enables us to determine the proper type and size of machine best suited to the need in advance of expenditure or installation. Sample of material may be furnished, if desired, with results kept in strict confidence.

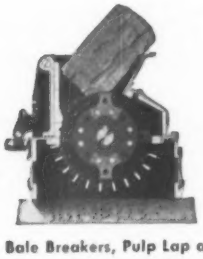
CRUSHER DIVISION



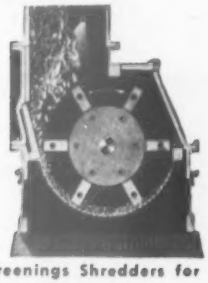
Type A Crusher with swing hammers



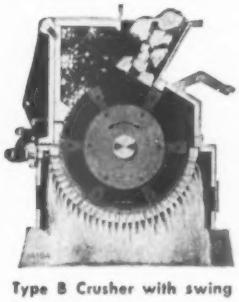
FLEXTOOTH and Rotary Ring Crushers



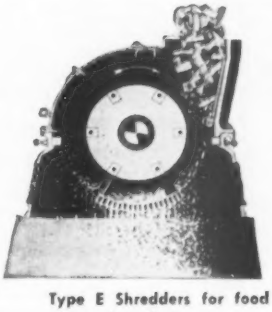
Bale Breakers, Pulp Lap and Crude Rubber Shredders



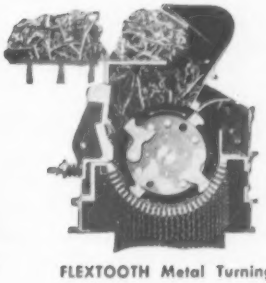
Screenings Shredders for chips, sewage, etc.



Type B Crusher with swing hammers



Type E Shredders for food or wood products



FLEXTOOTH Metal Turnings Crushers

ROCKBUSTER for reducing hard, friable material

THE JEFFREY MANUFACTURING CO.

ESTABLISHED 1877

Columbus 16, Ohio

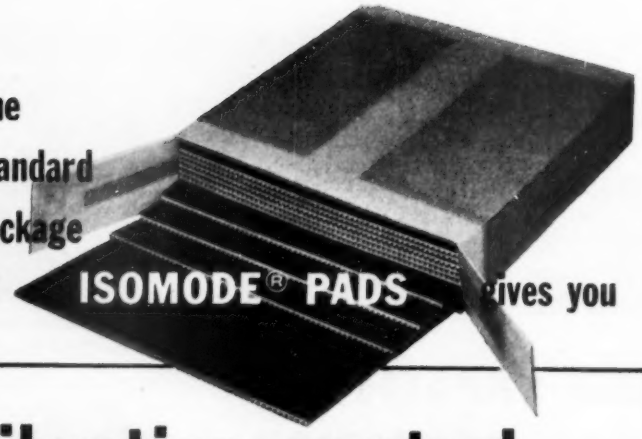
sales offices and distributors in principal cities

PLANTS IN CANADA, ENGLAND, SOUTH AFRICA

IF IT'S MINED, PROCESSED OR MOVED

. . .IT'S A JOB FOR JEFFREY!

One standard package of ISOMODE® PADS gives you



vibration control for 80 tons of machines

. . . INCLUDING PRESSES

It pays to keep at least one standard package of ten Isomode Pads in stock at all times. Costs less that way, and then you always have it on the spot for installing machinery – up to 80 tons of it. With that much equipment mounted on Isomode Pads, you'll *really* see a difference in plant operations. Here's why:

1. With Isomode Pads there's no need to bolt to or damage any type of floor. Machines stay put even without cementing. They're also easier to install, to move. They need no built-up bases.
2. By eliminating most of the disturbances normally transmitted through machine legs to floor, Isomode Pads help reduce noise level, increase comfort.
3. Vibration control enables you to locate machines for maximum production efficiency without disturbing offices or adjacent equipment. Improves quality of the work.
4. Flexibly mounted equipment means less damaging effect on building, less strain on machines. This cuts maintenance, saves money.

Isomode Pads support up to 50 lbs/sq. in. At these loads, they *efficiently* isolate machines from floor – absorbing both shock and vibration. Simply cut to size to fit under feet. Thousands of installations show these DuPont Neoprene pads last for years. Send in coupon.

® *Trade Mark Reg. U.S. Pat. Off.*

THE MB MANUFACTURING COMPANY, INC.
1080 State Street, New Haven 11, Conn.

Please send bulletin No. 415 containing more information on Isomode Pads and how to install them easily and quickly.

NAME _____ TITLE _____

COMPANY _____

ADDRESS _____

PRACTICAL LABOR RELATIONS

Begins on page 226

BRIEF BUT IMPORTANT

► **A Utah law would compel** those who would accept employment at a struck plant to register with the Industrial Commissioner. But its unconstitutional says that state's Supreme Court.

► **The CIO's net assets,** as of Sept. 30, 1952, were some $642,000 higher than the same time the year before.

► **Add Pontiac, Mich. as another FEPC city.** A recent ordinance bans racial or religious discrimination in employment and union membership.

► **The Taft-Hartley Act doesn't compel a union** to furnish a financial report to union members. It must do so only when it wants to use the NLRB's services.

► **Cafeteria price control.** Company cafeterias (those not open to the public) are free of price control regulations if employer controls prices charged.

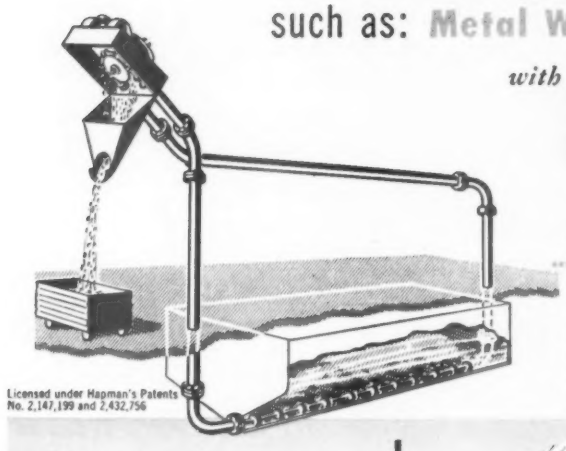
► **When your actuaries review your pension-plan costs,** as the result of their calculations they may say you have to increase your payments. You do not need WSB approval for such increases, provided employees who contribute still contribute the same percentages or amounts.

► **The National Labor Relations Board** puts the Indian sign on one employer by ruling the NLRB has jurisdiction over his mines, located on an Indian Reservation. The board failed to see his argument that a union would interfere with his relations with the tribal authorities or his Indian workers. (*Simplot Co. NLRB*)

Get automatic LOW COST handling of loose materials such as: Metal Working Chips • Dust • Scale • etc.

with

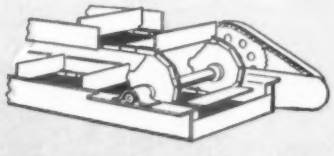
HOUDAILLE
Automatic Conveyors



Licensed under Hapman's Patents No. 2,147,199 and 2,432,756

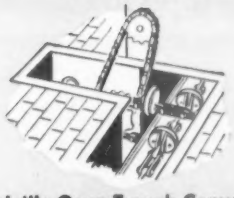
Houdaille Chain Drag Conveyors

Completely enclosed flights and chain automatically collect, transport and discharge chips, sludge, scale and other types of solid or fibrous material which settle to the bottom of tanks or hoppers. Standard pipe sizes — 3", 4", 6", 8". Larger sizes on request. Choice of chains, flights, casings, accessories also available.



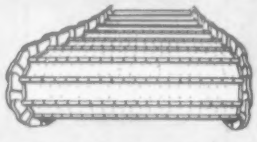
Houdaille Slat Type Conveyors

Slat type trough conveyors, operating individually or in sequence, transport material to any given point—can be operated continuously or intermittently as desired. Slats and chain move material in open troughs, return automatically to collection or transfer points.



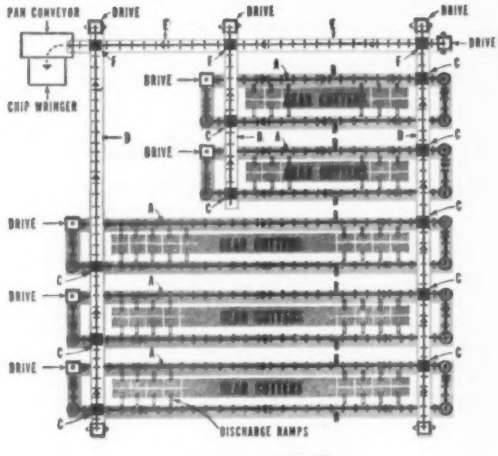
Houdaille Open Trough Conveyors

Chain Drag Conveyors installed in open troughs, running above or below floor level, offer many advantages in different types of operations. Below-floor-level installation, illustrated, continuously removes steel chips from machine tools, keeps system from interfering with heavy traffic plant areas . . . yet offers access to chain and flights at any point of circuit.



Houdaille Pan Type Conveyors

One-piece, heavy-gauge steel plates, featuring all-welded hinge construction, lock together firmly by means of connecting rod to form perfect pan-type conveyor for chips. Welded hinges, rod connections and side wings, securely interlocked even when chain negotiates sprocket or turns, prevent fall-through of material or jamming of conveyor. Plates perforated for drainage, depending on application. Ideal for installation on individual machines or large central chip handling systems.



TYPICAL OPEN TROUGH CHAIN CONVEYOR LAYOUT

Nine 6" Houdaille Open Trough Chain Conveyors operate automatically and continuously to remove steel chips from 500 Gleason Gear Cutters in large automotive plant. Five of the conveyors (A) pick up steel chips deposited into troughs (B) by the gear cutters. Each of the five conveyors services a battery of gear cutters aligned in a double row. Trenches, accommodating the open trough conveyors, wind completely around each double row of gear cutters up one side and down another. Chips empty into the troughs by means of a discharge ramp extending from each gear cutting machine.

Each of the five conveyors discharges chips at two points on their individual circuits (C). Here, three other 6" open trough chain conveyors (D), operating over and under the first five conveyors, collect, transport and ultimately discharge all of the chips into one main 6" open trough chain conveyor (E) at three points (F). At these points the chips are carried along the trough to a pan conveyor which discharges regularly into a chip wringer

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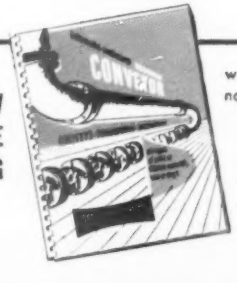

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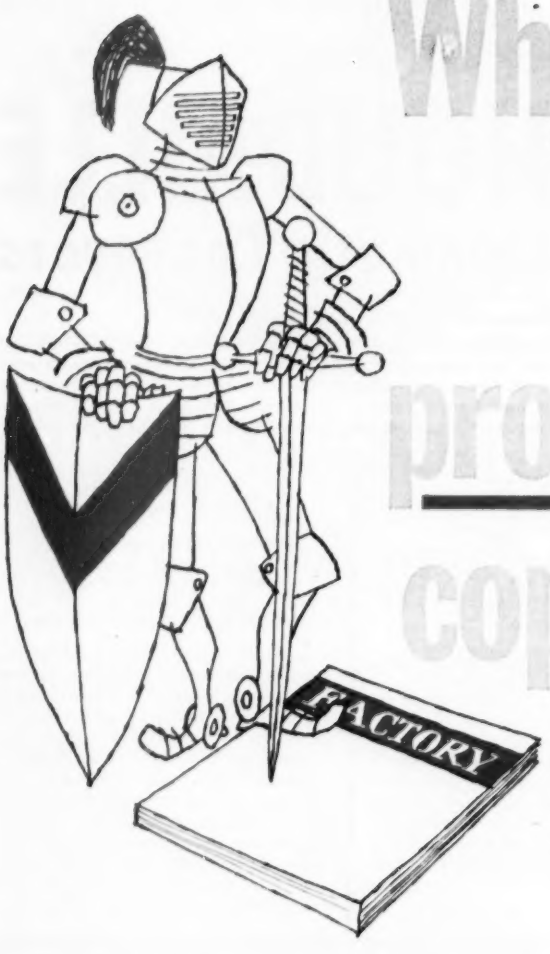

Why you will want to protect your copy of May FACTORY

1. BECAUSE OF ITS CONTENTS

May 1953 FACTORY will come to you in two *separately-bound sections:*

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1. **Buildings and Grounds**
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ibility in plants will permit quicker adaptation to different layouts and permit you to take advantage of improvements . . . new methods, ideas, and equipment that will help you get a better plant.

Section II—Plant Services . . . *how better plant services improve distribution of utilities services and why such improvements pay off in better operation and lower cost . . . new developments and new methods in plant service equipment . . . higher productivity from better plant services.*

Section III—Electrical Distribution . . . new trends in electrical distribution—and why they are important . . . what you need to know to justify purchase of new electrical equipment . . . changes in utility service . . . the need for buying the best equipment . . . flexible power systems . . . the advantages of more complex equipment.

Section IV—Materials Handling . . . *why plants are being designed—and redesigned—to take advantage of improved materials handling . . . the advantages of planning improved materials handling when the plant is being built or modernized . . . advantages and disadvantages of multi- and single-story plants . . . advances in packaging and shipping methods and equipment . . . economical use of yard space and yard handling equipment.*

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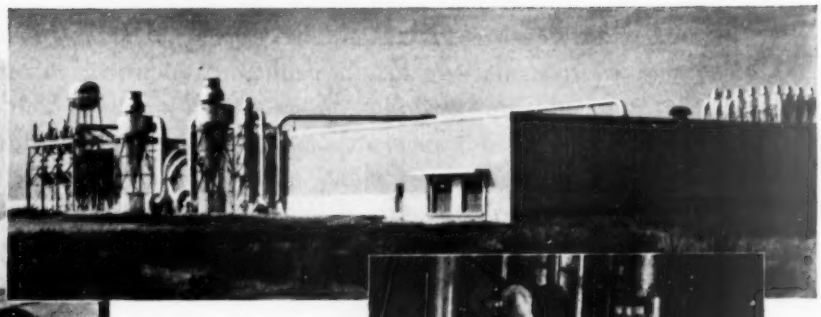
"FORMICA COUNTS ON 5000-7000 HOURS FROM G-E TUBES!"

Says **JOHN A. SCHINNER, Chief Engineer,**
The Formica Company, Cincinnati



"We've found that G-E tubes of all types give us an average 5,000 to 7,000 hours' life. That's high—saves tube replacements, so reduces costs.

"Formica is a large maker of laminated plastics. We use electronic tubes in at least 6 applications where long life and dependability are important. High-frequency heating, first. Then motor control . . . process timing . . . dust precipitation . . . smoke detection . . . plant communications.

"All along the line, G-E tubes do their jobs reliably. And General Electric tube distribution in Cincinnati has good stocks—makes fast deliveries—works closely with us to solve any tube problems."

★ ★ ★

To *you*—a user of electronic tubes for heating, welding, motor control, or other purposes—long life, reliability, fast and competent tube service are fully as important as to The Formica Company.

These tube advantages are characteristically G-E! Your nearby G-E tube distributor is waiting to make them available. Phone him today! *Tube Department, General Electric Company, Schenectady 5, New York.*

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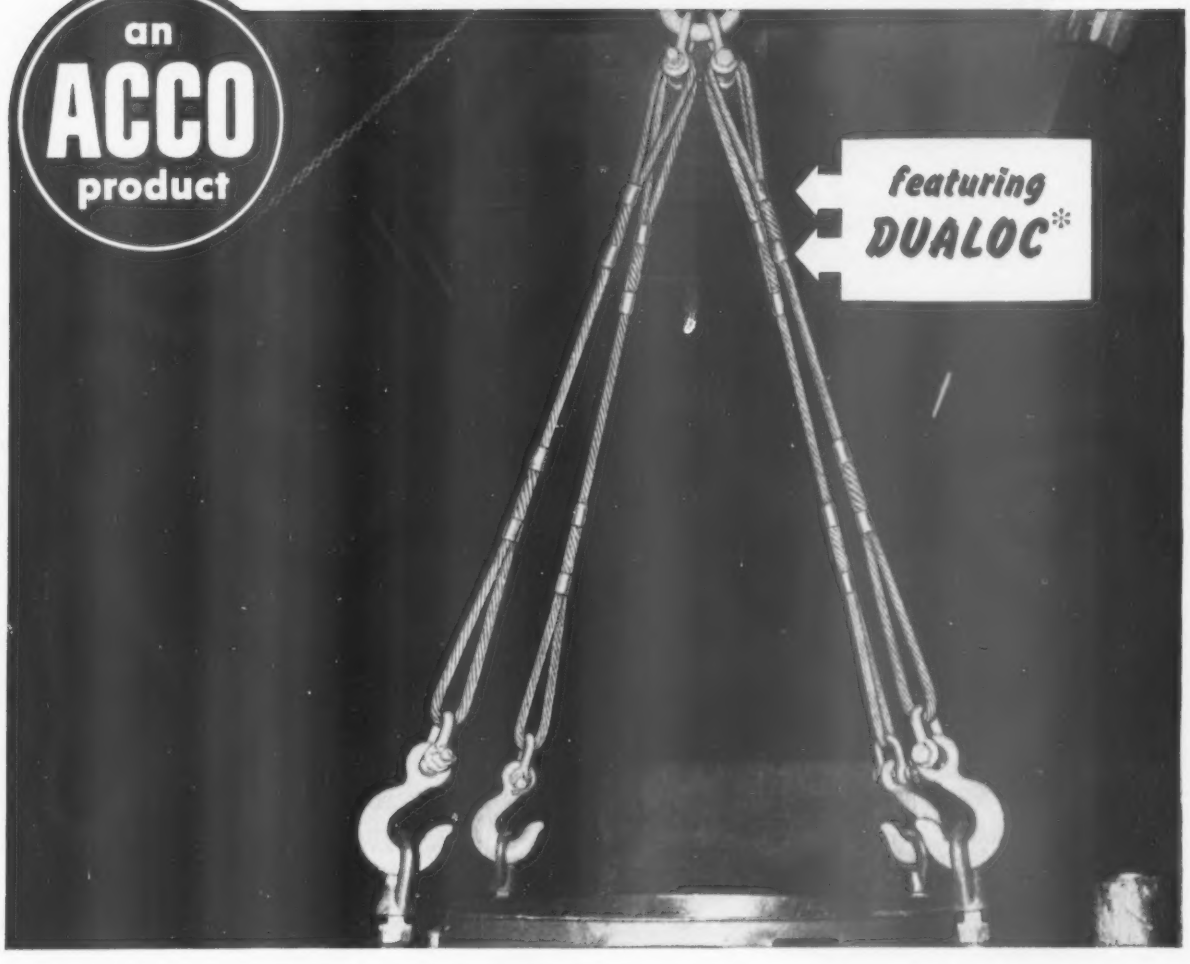

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Engineered by International industrial door specialists, fabricated by International Steel craftsmen, 40 one-piece vertical lift doors were installed in this 240′ x 600′ warehouse unit.

Along the railroad siding, the doors are 10′ x 8′ while on the trucking dock the doors are 14′ x 8′. All doors are balanced so that they may be easily opened, closed, or partially opened to any position.

International Steel fabricated the framing, also, for this Beeler Warehouse unit.

See the International Steel Industrial Door Catalog in Sweet's. And send for your personal copy of "Doors for American Industry."

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MATERIALS HANDLING

8 Custom-Built Conveyor Systems
Describes organization that will design, manufacture, and install handling equipment for you. You get 30 photographs of actual installations to demonstrate variety of jobs done and suggest applications. 8 pages. Palmer-Bee Co.

9 Cable Conveyors
There are features and application hints for a cable conveyor system in this 6-page folder. Details on components, attachments, and standard parts. Shows how it works, how various plants have put it to use. Cable-Link Corp.

10 Conveyors, Bucket Elevators
Here are three comprehensive catalogs—on belt conveyors (Cat. 850, 86 pages), spiral conveyors (Cat. 851, 43 pages), and bucket elevators (Cat. 852, 72 pages). Specs, dimensions, and how-to-use-it data. The Jeffrey Mfg. Co.

11 Overhead Cranes
Selection information on double-girder overhead electric traveling cranes from 1 to 20-ton capacity in this 28-pager. Construction details, application photos, and operating features. Catalog No. 221. Manning, Maxwell & Moore, Inc.

12 Gravity Conveyors
This 16-page catalog describes several kinds of roller and wheel gravity-type conveyors. There are sketches, application data, specs, and sizes. Section on accessories. Packing Equipment Div., Food Machinery & Chemical Corp.

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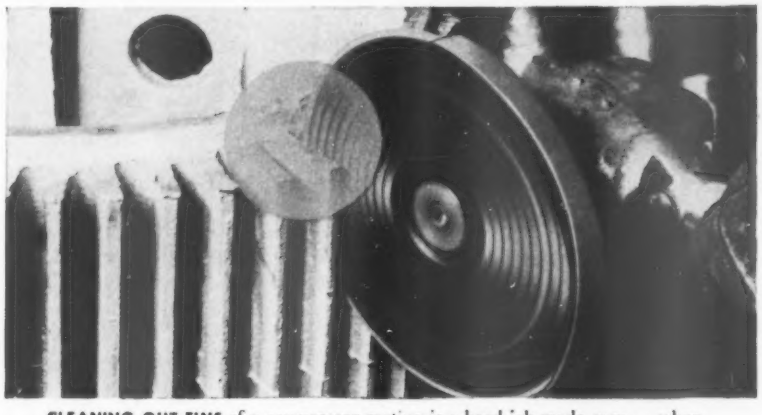
BLENDING IN A WELDED CORNER is a job you can do faster and better with a Norton BFR semi-flexible wheel.



CLEANING OUT FINS of a compressor casting is a hard job made easy — when you use a Norton BD rigid hub wheel.

NEW!... The Norton BF Wheel For Light Finishing

Meet the latest Norton development for your lighter finishing jobs. Basically, the new BF wheel is built like the BFR wheel but is designed especially for periphery grinding. You'll find its flexibility in the softer grades (G and I) ideal for blending and smoothing curved surfaces and corners. The hardest grade (K) is more rigid — best for light welds and sharp edge applications. In all grades it tends to finish as it cuts.

Like the BFR and BD wheels, the new BF wheel cuts fast and free and has a high safety factor. Like them, too, it features versatility, covering a range of usefulness that includes finishing stainless steel welds, deburring metal parts such as stampings and removing gates and fins from molded plastics. Let the new BF wheel add "The Touch of Gold" to many of your own light-duty grinding jobs.

Smoothing welds in a fabricated cone — semi-flexible BFR

Notching risers on gray iron castings — either type

Here's your "TOUCH OF GOLD" team for more economical portable grinding

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They're the long popular Norton BD rigid and the newer Norton BFR semi-flexible — the most useful pair of hub wheels ever built. They're lighter and easier to handle than cup wheels, longer lasting than coated abrasive discs, and more versatile than either.

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Catalog No. 102 has 32 pages on portable conveying equipment —conveyors, bucket loaders, automatic baggers, and other equipment. Engineering drawings, specs, and application information for each type of equipment. J. C. Corrigan Co., Inc.

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14 Fans, Ventilators
Turbine ventilators, roof fans, and exhaust fans are subjects of this 8-page catalog. Charts and tables help you select. Drawings and photographs illustrate complete line. Catalog No. 481-B. Allen Ventilator Div., Production Planning Co.

15 Finned Tubing
In this bulletin (No. 535) you get the facts on how to use finned pipe coils as a heating source. Specs and illustrations, basic rating tables, and correction factors. Detailed drawings and dimensions. 4 pages. Bush Mfg. Co.

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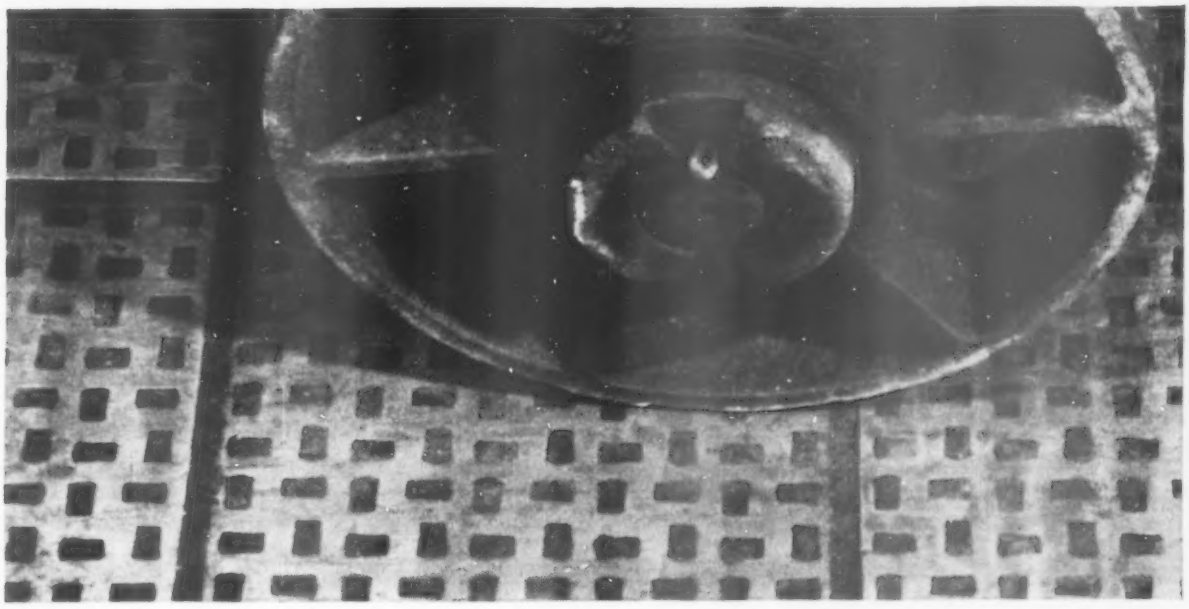

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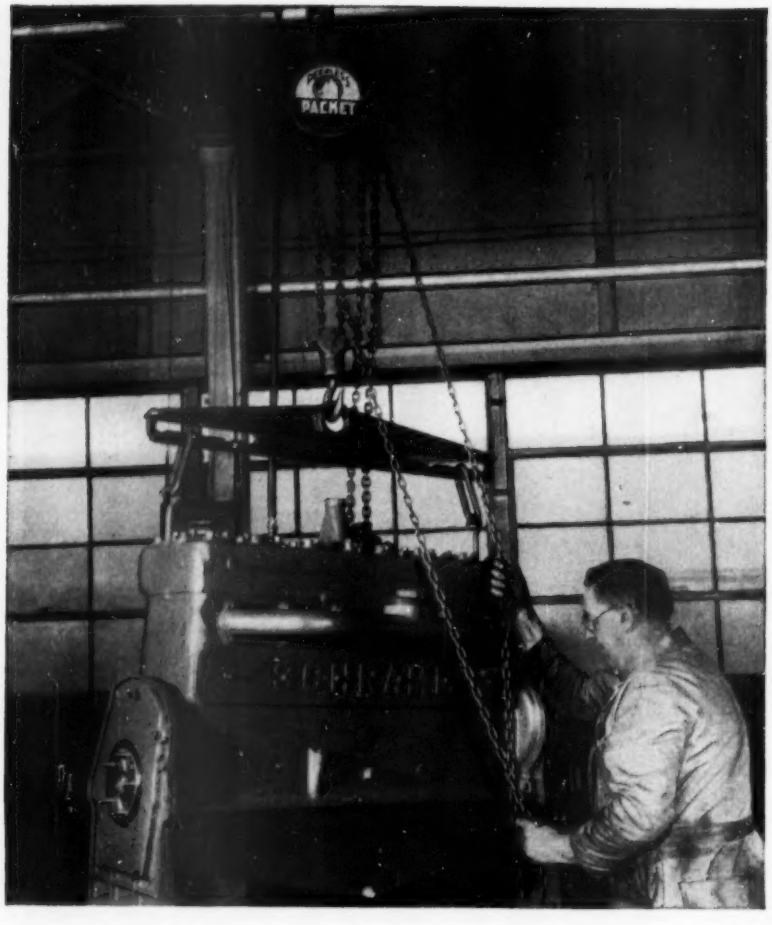

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19 Panelboards, Circuit Breakers
A pair of 16-page catalogs describe maker's panelboards and circuit breakers. Selection charts, installation data, typical wiring diagrams. Catalog Nos. C. B. 1075, PB 500. Federal Electric Products Co.

CONTROLS

20 Industrial Controls
Complete line of industrial controls is outlined here: temperature and humidity controls, motor-operated valves, and control motors. Applications, dimensions, and charts. Catalog No. F 3941-2. Barber-Colman Co.

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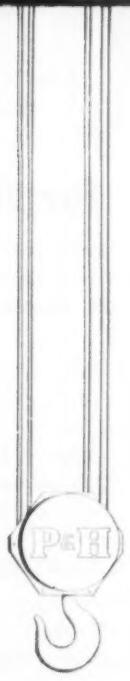

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HARNISCHFEGER CORPORATION

Milwaukee 46, Wisconsin

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You learn how you can use plastic and glass cloth tapes in wiring, cable splicing, and other electrical applications. 12-page catalog tells exactly how to select and apply each type of tape. Minnesota Mining & Mfg. Co.

24 Cold Treatment, Refrigeration Units
Bulletins on refrigeration units for testing, storage, and processing suggest applications and describe features. Advantages of cold treatment of metals are outlined. Bowser Technical Refrigeration.

25 Tubular Electric Heating Elements
There are 14 manufacturing applications of tubular, metal-sheathed, electric heaters in this 16-page catalog. Shows how the devices have been applied to heating surfaces, areas, and liquids. Bulletin No. GEA-5866. General Electric Co.

26 Boiler-Burner Units
You'll find a complete range of boiler-burner package-heat units for many industrial applications. Catalog No. 2314 lists features and complete selection data. 15 pages. Kewanee-Ross Corp.

27 Demineralization, Silica Removal
This 28-page catalog tells how you can use ion-exchange resins for demineralization and silica removal. Describes applications, operation, and features. Bulletin No. 3803. Permutit Co.

28 Water Conditioning
Gives you the story on a unit for softening, filtering, or removing iron from your plant water. You get specs, capacity table, and sketch of typical installation. Describes services offered. 4 pages. Uniflow Mfg. Co.

For catalogs 29 through 47, see Plant Engineering Problems, page 250, and Plant Operating Problems, page 254.

DUPLICATE COUPON ON PAGE 154

MAIL THIS COUPON FOR FREE CATALOGS *(Good until May 31, 1953)*

FACTORY MANAGEMENT & MAINTENANCE (March 1953)
330 W. 42nd St., New York 36

I'm circling the numbers of the catalogs and bulletins I want:

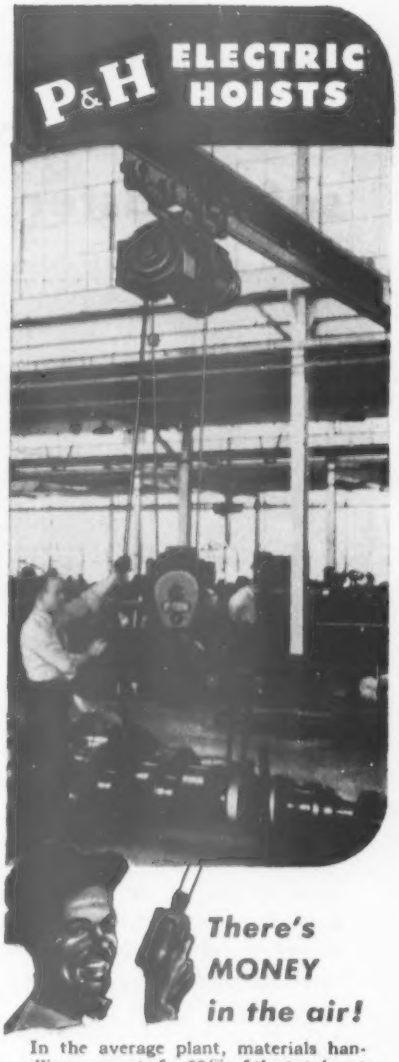
1	2	3	4	5	6	7	8	9	10	11	12	13
14	15	16	17	18	19	20	21	22	23	24	25	26
27	28	29	30	31	32	33	34	35	36	37	38	39
40	41	42	43	44	45	46	47					

Name ..... Title .....

Company .....

Street Address .....

City ..... Zone..... State.....



There's MONEY in the air!

In the average plant, materials handling accounts for 20% of the total cost of the product. How about your operation? Are skilled workers wasting your time and money being load-lifters? There's a better way —

Handle it "thru-the-air" FASTER—FOR LESS!

P&H can help you cut costs, with swift, safe movement of loads above floor congestion. There's a P&H Electric Hoist to suit your needs exactly; the Zip-Lift for loads up to 1 ton—the Hevi-Lift for loads up to 15 tons—available with hook, jib or trolley mounting. A P&H representative can show you where and how to save money.

Call your P&H Dealer

P&H ELECTRIC HOIST DIVISION
HARNISCHFEGER CORPORATION
MILWAUKEE 46, WISCONSIN

Every day more and more factory men tell us —

Tokheim hand pumps are safer, faster, more useful!

This new Tokheim double-action hand pump has no equal for speedy, safe handling of liquids. Delivers 20 gallons per minute of most fluids. Stops wasteful dripping and slippery floors. Reduces fire hazard and accidents common to other methods of transfer. With optional diaphragm and body, it handles a wide variety of products. Compare list below with your own needs. UL-approved for petroleum liquids. Available in hose and spout models—for drums, skid tanks and underground installations. Call your dealer, your Tokheim representative, or write the factory for literature.

QUALITY TOKHEIM DOUBLE-ACTION HAND PUMPS

A Tokheim will handle a variety of liquids

Acetates • Alcohols • Aromatic & Chlorinated Solvents • Glycols • Ketones & Ethers • Petroleum Solvents • Plasticizers • Petroleum Products • Ammonia • Ammonia Hydroxide • Cutting Oils Flushing Oils • Lacquer Thinners • Anti-Freezes Castor oil • Caustic Soda Solution • Freon • Glycerine • Turpentine • Water • Wood & Vegetable Oils.

General Products Division

TOKHEIM OIL TANK AND PUMP COMPANY

DESIGNERS AND BUILDERS OF SUPERIOR EQUIPMENT SINCE 1901

1652 WABASH AVENUE, FORT WAYNE 1, INDIANA

Factory Branch: 1309 Howard Street, San Francisco 3, California

Good Ways to Solve Special PLANT ENGINEERING PROBLEMS

You can get catalogs suggested as answers to these problems by using coupon on page 154 or 249.

HOW TO BUILD YOUR OWN OVERHEAD CONVEYOR: You can learn from a 28-page catalog (No. JM 2) offered by Mechanical Handling Systems, Inc. Tells you all need to know to make the layout, select the parts you'll need, and install them. *(Circle No. 29 on coupon, page 154 or 249.)*

GOT A DIFFICULT BRAKING PROBLEM? Here's a brake to fit almost any machine, says Goodyear Tire & Rubber Co. of its industrial disc brakes. They can be operated hydraulically, mechanically, or pneumatically, or can be spring-set and solenoid-released. *(Circle No. 30 on coupon, page 154 or 249.)*

TO PREVENT DUST WHEN LOADING STORAGE BUNKERS, you can use a zipper bunker seal made by Stephens-Adamson Mfg. Co. It consists of two zipper-toothed belt strips and an opening and closing mechanism. Bulletin No. 952 shows how it works. *(Circle No. 31 on coupon, page 154 or 249.)*

HOW TO WEIGH TRUCK OR FREIGHT LOADS up to 50 tons within 5 pounds: It's easy with electronic scales that work on the strain-gage principle, says Cox & Stevens Aircraft Corp. Inexpensive to install. *(Circle No. 32 on coupon, page 154 or 249.)*

NEED TO INSTALL A MOVABLE FIREWALL in your plant? Mobilfirewall is approved by Underwriters' Laboratories as a 1-hour fire partition. Virginia Metal Products Corp. says it is ideal for use in storage areas. *(Circle No. 33 on coupon, page 154 or 249.)*

Turn the page

LET *Specialists* DO THE JOB OF MOVING GAS OR AIR

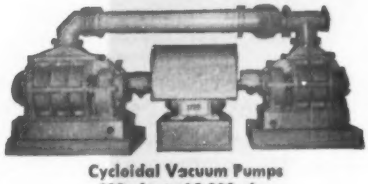
CENTRIFUGAL BLOWERS AND EXHAUSTERS
single and multi-stage units, in capacities from 2,000 cfm to 100,000 cfm or higher, at maximum practical pressures.

Rotary Positive Gas Pumps
5 cfm to 50,000 cfm.

Inert Gas Generators
1,000 cfh to 35,000 cfh.

Rotary Positive Blowers and Exhausters
5 cfm to 50,000 cfm.

Positive Displacement Meters
4,000 cfh to 1,000,000 cfh.



Cycloidal Vacuum Pumps
500 cfm to 13,000 cfm.

One advantage of dealing with Roots-Connersville for blowers, exhausters, meters and related equipment is that we are specialists in this field. It's been our only business for almost a century. Today, we combine this long experience with up-to-the-minute thinking, to supply the most reliable and economical machine for your specific job.

Then, there's the wide versatility of R-C equipment. Our exclusive *dual-ability* line includes Centrifugal and Rotary Positive types, in standard sizes for most work. Because we build both, our recommendations are unbiased.

In our Rotary Positive Gas and Vacuum Pumps and Meters, and in Inert Gas Generators, there's a similar, wide choice in types and capacities, closely matched to specific needs.

We suggest that on *any* problem of handling gas or air at moderate pressure, for industrial purposes, you ask us for definite recommendations. Detailed bulletins are available on request.

ROOTS-CONNERSVILLE

Exclusive Specialists in Handling Gas and Air

ROOTS-CONNERSVILLE BLOWER A DIVISION OF DRESSER INDUSTRIES, INC.
453 Central Ave. • Connersville, Indiana

Two profitable ways you can use Cleveland's Production Service for your Specially Designed Parts
Your non-standard parts can be manufactured *complete* (above) . . . or pre-formed by forging, ready for further shaping and machining in your plant (below). Made by the Kaufman *Double Extrusion* Process, your design is produced with accuracy in dimensional detail—is *stronger* through forging by our process.
Find out how Cleveland can help you in your special parts production. Write for bulletin "Specials by Specialists"
CLEVELAND *Top Quality* FASTENERS
originators of the Kaufman DOUBLE EXTRUSION Process

Begins on page 250

Good Ways to Solve Special

PLANT ENGINEERING PROBLEMS

You can get catalogs suggested as answers to these problems by using coupon on page 154 or 249.

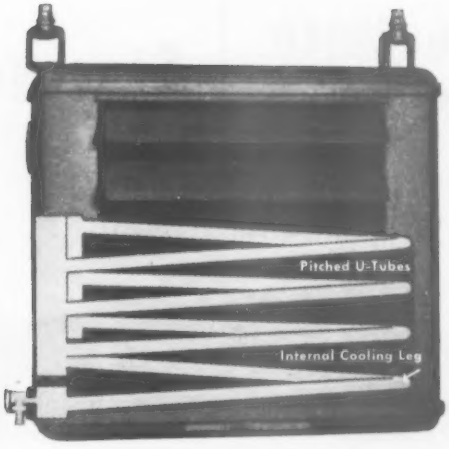
ARE METAL FASTENERS THE WEAK LINK in your fume exhaust systems? You can have exhaust systems, process equipment, and tanks custom-made of corrosion-resistant Ampcoflex plastic throughout. This includes even nuts, bolts, flanges, and other fittings, according to Atlas Mineral Products Co. (*Circle No. 34 on coupon, page 154 or 249.*)

CAN'T GET A LEAKPROOF GASKET to stop those corrosion leaks? Take a look at Tygon, says U. S. Stoneware Co. in Bulletin No. G-520. This tough, corrosion-resistant material will resist oil, greases, gasolines, and most solvents. Available in special non-toxic formulations for food and beverage applications. Comes in sheeting, tubing, and molded to specification. (*Circle No. 35 on coupon, page 154 or 249.*)

TO IMPROVE EFFICIENCY OF YOUR ELECTROSTATIC PRECIPITATORS, the Research Corp. has designed its M. I. continuous electrode rapping system. Bulletin No. M1 explains how it's much more efficient than intermittent rapping methods. (*Circle No. 36 on coupon, page 154 or 249.*)

WHEN MACHINE WAYS OR SLIDING PARTS WEAR or get overheated, maybe you can reduce friction by using Formica End Grain Grade C bearing surfaces. Formica Co. says it can be installed easily, quickly, and inexpensively. You can cut your wear plates to size from standard sheets, or you can have them fabricated. (*Circle No. 37 on coupon, page 154 or 249.*

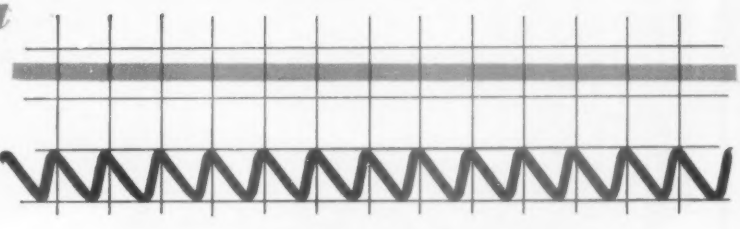
Turn the page



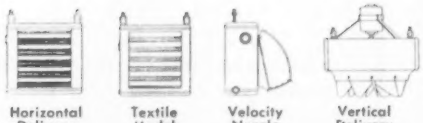
when buying unit heaters

be sure you get this

...not this!



With **THERMOLIER**...
the Grinnell Unit Heater . . . you get
CONTINUOUS RATED CAPACITY



THERMOLIER FEATURES

INTERNAL COOLING LEG A Grinnell feature which permits the use of a plain thermostatic trap for draining condensate.

PITCHED U-TUBES Built-in pitch of U-tubes provides complete drainage of condensate and elimination of destructive water hammer.

CONTINUOUS RATED CAPACITY The combination of Thermolier's internal cooling leg and the built-in pitch of tubes assures continuous rated capacity.

BUILT-IN EXPANSION PROVISIONS Every tube is an expansion bend of the U type to allow for independent expansion and contraction of each tube.

TUBE-TO-HEADER CONSTRUCTION Safety and durability assured by unique tube-to-header construction.

EASE OF ERECTION Exclusive with Thermolier are the adjustable swivel couplings which provide an easy, cost-saving method of hanging the unit.

SIMPLE PIPE CONNECTIONS The supply and return piping connections are on the same side to assure compactness, neatness and economy in installation.

MOTORS Thermolier motors are built specifically for unit heater duty. They give maximum operating efficiency with minimum power cost.

The practical advantages of unit heating, of course, are well known. But in order to get *maximum* economy and efficiency, certain engineering and structural features *must be* present in the unit heater of your choice.

Take provisions for draining off condensate. Failure to provide freedom from collected condensate in the heating element can interfere with heat output and adversely affect capacity.

A Thermolier Unit Heater successfully handles this drainage problem with its pitched U-tubes and internal cooling leg, through which all the condensate passes. In fact, condensate cooling is so efficient with Grinnell Thermoliers that a thermostatic trap — the simplest and least expensive of all traps — can be used with every model. Condensate temperature is lowered to the point where the trap is always draining — giving Thermolier Unit Heaters their *continuous rated capacity*.

Check Thermolier's advantages at left. For more details, call your local Grinnell distributor — or send for catalog.

GRINNELL
THERMOLIER UNIT HEATERS

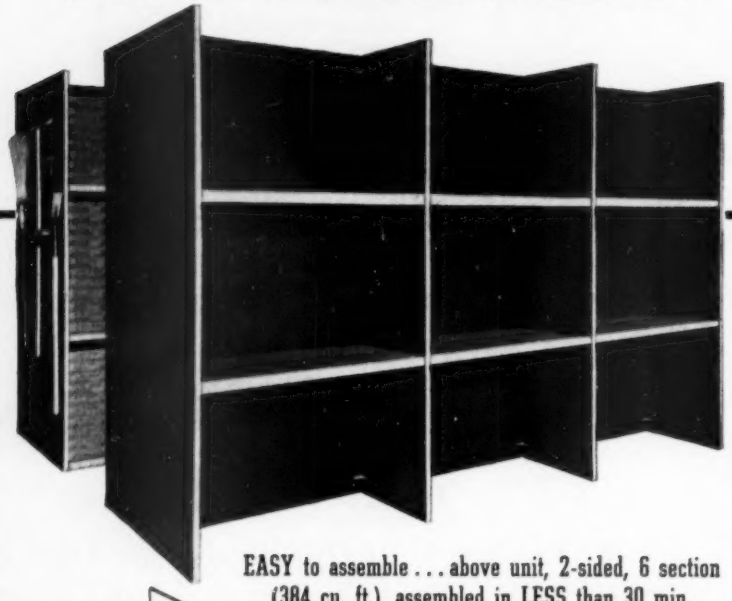
Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

Manufacturer of: pipe fittings • welding fittings • forged steel flanges • steel nipples • engineered pipe hangers and supports Thermolier unit heaters • Grinnell-Saunders diaphragm valves • prefabricated piping • Grinnell automatic fire protection systems

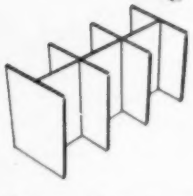
PEG-BOARD

Storage unit

NEW LOW-COST, STRONG INDUSTRIAL SHELVING • NOW AVAILABLE for IMMEDIATE DELIVERY

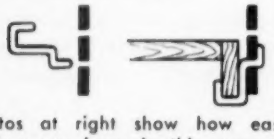


EASY to assemble . . . above unit, 2-sided, 6 section (384 cu. ft.), assembled in LESS than 30 min.



You can order "PEG-BOARD" industrial shelving units to fit your specific storage requirements. They are easy to assemble, yet carry a heavy load. Made of tough perforated hardboard mounted to sturdy cross-braced frames, the "PEG-BOARD" storage unit gives you economy, versatility and strength.

Shelves adjust to any height on 1" spacings. Shelves are inserted or adjusted in a matter of seconds with special self-locking hangers as illustrated below. No tools of any kind required for assembly.



Photos at right show how easily shelves are hung in this new unit. Shelves may be positioned at any height on upright sections. Each shelf is tough hardboard mounted to cross-braced frame. 1000 lb. load per shelf. The new "PEG-BOARD" low-cost units are available now . . . **no waiting** for delivery.

WRITE TODAY FOR PRICES

B. B. BUTLER MFG. CO., INC.

3151 Randolph Street • Bellwood, Illinois

Good Ways to Solve Special

PLANT ▶ OPERATING PROBLEMS

You can get catalogs suggested as answers to these problems by using coupon on page 154 or 249.

TO HELP EMPLOYEES GET MORE OUT OF REAMERS AND TWIST DRILLS, two comprehensive booklets are offered by Cleveland Twist Drill Co. Lots of helpful hints on selection, use, and care of the tools. 96 pages in all. (*Circle No. 38 on coupon, page 154 or 249.*)

IF YOU WANT TO CUT COSTS ON FINISHING, why not try the backstand-belt method? Armour & Co. says abrasive belts produce a fine, uniform finish with few operations. Booklet tells about equipment needed and techniques used. (*Circle No. 39 on coupon, page 154 or 249.*)

KNOW THE TRICKS TO WORKING PLEXIGLAS? Cadillac Plastics Co. covers just about every operation you can think of in its 16-page "how-to" brochure. Easy-to-follow, illustrated instructions for each section. (*Circle No. 40 on coupon, page 154 or 249.*)

FOR THE EASY WAY TO PERMANENTLY MARK HARD SURFACES, Jas. H. Matthews & Co. suggests Airgrit. Tiny particles of grit are blown through a stencil. No danger of distortion or fracture to thin-walled. (*Circle No. 41 on coupon, page 154 or 249.*)

TO AVOID MIXUPS IN IDENTITY, mark your metal with Mecco safety marking tools. M. E. Cunningham Co., Inc., brings you more than 100 different pieces of marking equipment in Catalog No. 100. Special steel alloy is said to reduce spalling and mushrooming. 28 pages. (*Circle No. 42 on coupon, page 154 or 249.*)

Turn the page

Facts prove the economy of RUST-OLEUM®

Apply Directly Over Sound Rusted Surfaces

Just scrape and wirebrush to remove rust scale and loose particles — then brush Rust-Oleum 769 Damp-Proof Red Primer *directly over sound rusted surface.*

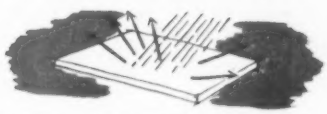
Lasts Longer Applied Directly Over Rust

Sandblasting, chemical pre-cleaning and other costly preparation methods are *not* usually required. Rust-Oleum penetrates the rust to bare metal, incorporating the rust particles into the coating.

Many Colors, Including Aluminum, and White

Rust-Oleum finish coatings incorporate the same basic rust-inhibiting vehicle as Rust-Oleum 769 Damp-Proof Red Primer. They provide *double protection* and enable you to *beautify as you protect.*

Practical Answer to Your Rust-Producing Conditions



Rust-Oleum resists rain, snow, heat, fumes, sun, salt water, and chemicals. So easy to use by brush, dip, or spray that one man often does the work of two.

Proved Throughout Industry for Over 25 Years

Indoors and out, Rust-Oleum has *proved* its capacity to stop rust! Rust-Oleum can do the same for your tanks, metal sash, stacks, girders, roofs, buildings, machinery, pipes, etc.

An Exclusive Formula

Rust-Oleum is *distinctive* as your fingerprint. It incorporates a specially-processed fish oil vehicle that *dries,* is *odor-free,* and is formulated in *many colors.* Specify Rust-Oleum — accept no substitutes.

There Is Only One Rust-Oleum

RUST-OLEUM STOPS RUST!

ATTACH TO YOUR LETTERHEAD — MAIL TODAY!

RUST-OLEUM CORPORATION
2453 Oakton Street, Evanston, Illinois

- ☐ Have a Qualified Representative Call
- ☐ Free Survey
- ☐ Complete Literature
- ☐ Nearest Rust-Oleum Industrial Distributor

PACKAGED V-BELT FAN UNITS

BETTER FOR MANY AIR HANDLING APPLICATIONS

NEW! CLARAGE DEVELOPMENT

Clarage Ready Units are a notable advance in "packaged" fan units — highly efficient, compact, quiet in operation. And, like all other Clarage equipment, you can RELY on them for dependable, economical service.

MOTOR DRIVEN ASSEMBLIES—NO EXPENSIVE FOUNDATIONS REQUIRED

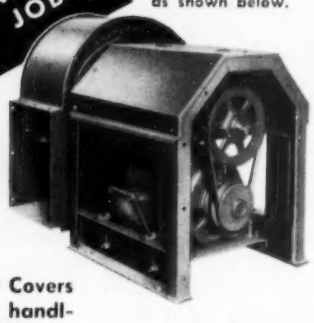
Clarage V-belt Ready Units come in 18 sizes—capacities to 12,000 c.f.m. . . . ECONOMY ANSWER to both INDOOR and OUTDOOR industrial air handling requirements.

Use Ready Units and save the expense of separate motor foundations. Use Ready Units and eliminate alignment problems. Use Ready Units for installations at lowest cost consistent with quality fan equipment.

Ready Units with or without Outdoor Covers shipped immediately. Special units for handling corrosive gases, etc., take longer.

INDOOR JOBS

Standard Ready Units (except three largest sizes) afford protection to fan bearings, motor and drive as shown below.



WRITE FOR READY UNIT CATALOG 515

— a twenty-eight page book, giving descriptive details, capacities and dimensions on the most modern "packaged" fan units available today. No obligation — address, CLARAGE FAN COMPANY, Kalamazoo, Michigan.

OUTDOOR JOBS

Cut below shows Ready Unit equipped with (easily removable) Outdoor Covers shielding all working parts from rain and snow.

68 PAGES OF VALUABLE INFORMATION

New Manual shows how to properly install and service Clarage fans, blowers and air conditioning units . . . valuable information adaptable to almost any type of fan job. Sent without charge to factory executives, engineers and maintenance officials.

You can Rely on...

CLARAGE

Headquarters for Air Handling and Conditioning Equipment

SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES • IN CANADA: Canada Fans, Ltd., 4285 Richelieu St., Montreal

Begins on page 254

Good Ways to Solve Special PLANT ▶ OPERATING PROBLEMS

You can get catalogs suggested as answers to these problems by using coupon on page 154 or 249.

HOW TO GET MORE STAMPING CAPACITY: Henry & Wright Mfg. Co. says you ought to take a look at its dieing machines. A 60-page catalog shows how you can get high-speed production with the progressive die method. Machines of 25- to 400-ton capacity. Catalog No. 53 (*Circle No. 43 on coupon, page 154 or 249.*)

WHAT'S YOUR GAGE-CONTROL PROBLEM? Whatever it is, you're bound to find help in Pratt & Whitney's 28-page catalog. Applications and operating data on full line of equipment. (*Circle No. 44 on coupon, page 154 or 249.*)

NEED MOLDED NYLON KNOW-HOW? Then you'll want Du Pont's 52-page handbook on the subject. It tells how you can use the tough, lightweight material in production. (*Circle No. 45 on coupon, page 154 or 249.*)

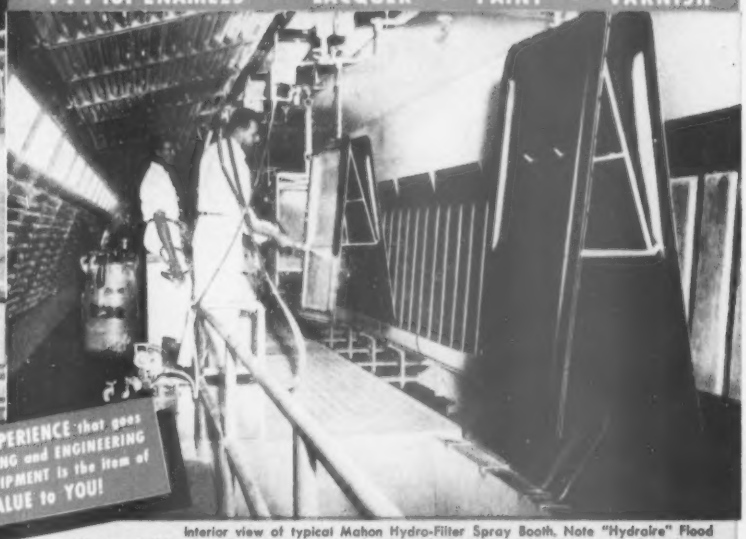
DOES RAISING SMALL PARTS RAISE HOB with production? You can handle them lots easier magnetically, according to Prab Conveyors, Inc. Its Magnavator is completely automatic, can be had in standard or custom-made models. (*Circle No. 46 on coupon, page 154 or 249.*)

IF YOU WANT TO CUT PAINT WASTES DOWN TO 2%, says Scientific Electric, try its new Ionic Gun for paint spraying. Paint is first highly ionized. When it's sprayed at the object, it can differentiate between painted and unpainted surfaces. This gives even finish. (*Circle No. 47 on coupon, page 154 or 249.*)

COMPLETE *Finishing* SYSTEMS

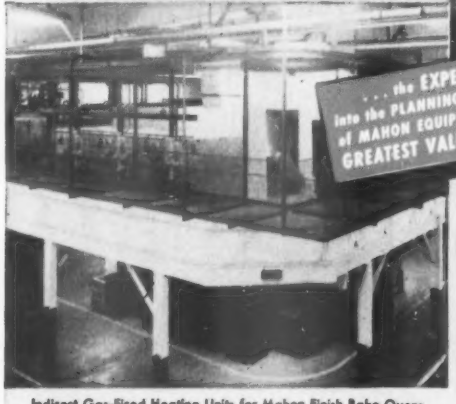
. . . for ENAMELS • LACQUER • PAINT • VARNISH

General view of Mahon installation showing air Supply System overhead in foreground and bottom entrance Finish Baking Ovens overhead in the background.



. . . the EXPERIENCE that goes into the PLANNING and ENGINEERING of MAHON EQUIPMENT is the item of GREATEST VALUE to YOU!

Interior view of typical Mahon Hydro-Filter Spray Booth. Note "Hydraire" Flood Sheet and "Microfusers" which provide perfect control of air flow in working area of the booth.



Indirect Gas-Fired Heating Units for Mahon Finish Bake Ovens and all Recirculating and Exhaust Fans are also located overhead to save manufacturing floor space.

Gas Burners and part of the Automatic Control Equipment necessary to maintain constant prescribed temperatures in the various Stages of a Modern Mahon Finish Baking Oven.

Modern Equipment Pays Dividends in Finer Finish, Lower Cost, and Better Working Conditions!

Production Finishing Equipment is constantly being improved . . . new developments such as the Mahon Fire-Jet solution heating units for cleaning and rust proofing equipment, better control of air flow in the working area of the Mahon Hydro-Filter Spray Booths, improved Flow-Coaters, automatic and conventional Dip Coaters, better automatic control of heat stages in Mahon Finish Baking Ovens, new Vacuum Booths, and many other improvements which are the result of constant research and development carried on by the Mahon Company in search of better methods which result in finer finishes at lower cost. The equipment illustrated here was recently installed in the plant of one of the world's largest home appliance manufacturers . . . it is ultramodern in every respect. If you are contemplating new finishing equipment, you will find Mahon engineers are better qualified to determine your equipment requirements and to plan and produce the most efficient production finishing equipment available today . . . equipment which will prove to be the most economical from a standpoint of maintenance and operating cost. Remember, Mahon has pioneered in this highly specialized field for over thirty years . . . remember, also, that more automobiles and more home appliances are finished in Mahon Finishing Systems than all other types combined. See Sweet's Plant Engineering File for further information, or write for Catalog A-653

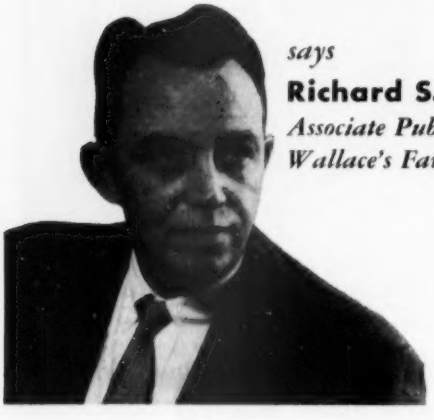
THE R. C. MAHON COMPANY

HOME OFFICE and PLANT, Detroit 34, Mich. • WESTERN SALES DIVISION, Chicago 4, Ill.

Engineers and Manufacturers of Complete Finishing Systems—Including Metal Cleaning and Pickling Equipment, Metal Cleaning and Rust Proofing Equipment, Hydro-Filter Spray Booths Filtered Air Supply Systems, and Drying and Baking Ovens; Core Ovens, Heat Treating and Quenching Equipment for Aluminum and Magnesium, and other units of Special Production Equipment.

MAHON

"Glare is eliminated, machinery works better, workers are comfortable since we installed PC Glass Blocks"



says
Richard S. Pierce,
Associate Publisher,
Wallace's Farmer Magazine

With the wide climatic changes in Des Moines, Iowa, the windows in this building bulged out as much as six inches. The problem was so severe in winter that the windows were sealed and actually caulked for the season. Even so, wind whistled in through cracks in the caulking. It got so bad that the delicate printing machinery was affected, and employees complained of the chill.

It was just as bad in the summer. The glare and heat were so intense that the entire window area was painted to make the interior more bearable.

Now, with PC Light-Diffusing Glass Blocks, the problem has been solved. "Glare has been completely eliminated," says Mr. Pierce.

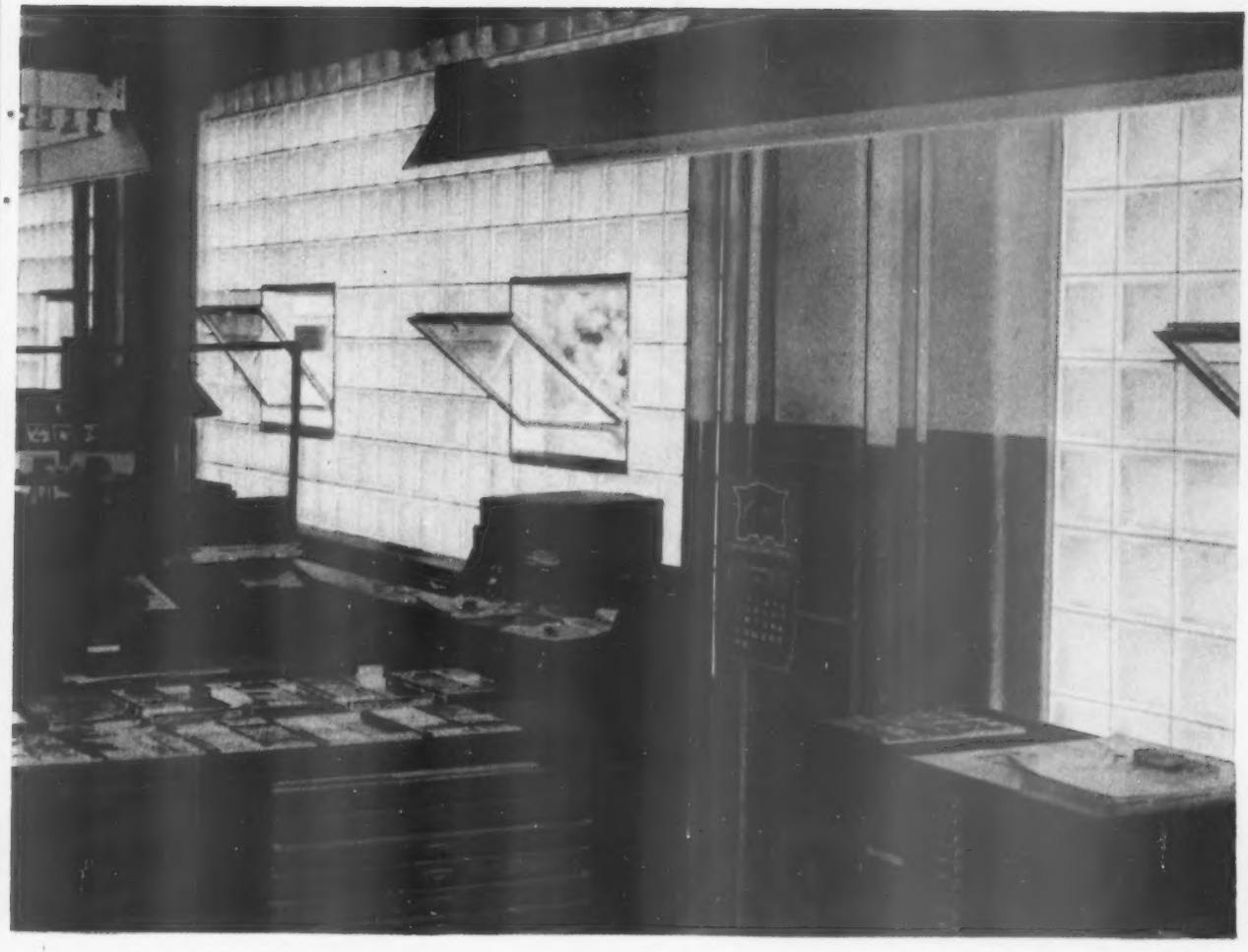
The heat problem? "Because of the insulating properties of these blocks, our employees are very comfortable," says Mr. Pierce, "And we completely eliminated a burdensome replacement and maintenance problem."

Obsolete sash can cost you a small fortune in terms of high maintenance, high heat loss and employee discomfort. You can lick all three problems, and get a better-looking building in the bargain with PC Glass Blocks.

See for yourself. Send the coupon today.

Pittsburgh Corning Corporation

PITTSBURGH 22, PA.



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- **SOFT-LITE* EDGE**—opal glass insert at edge of block cuts edge glare, creates soft, uniformly lighted panel.
- **DIFFUSING SCREEN**—divides block into 2 halves, raises insulation value, diffuses light, cuts glare. Available in certain styles.
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☐ Send engineer to discuss specific problem. ☐ Advise nearest source of supply.

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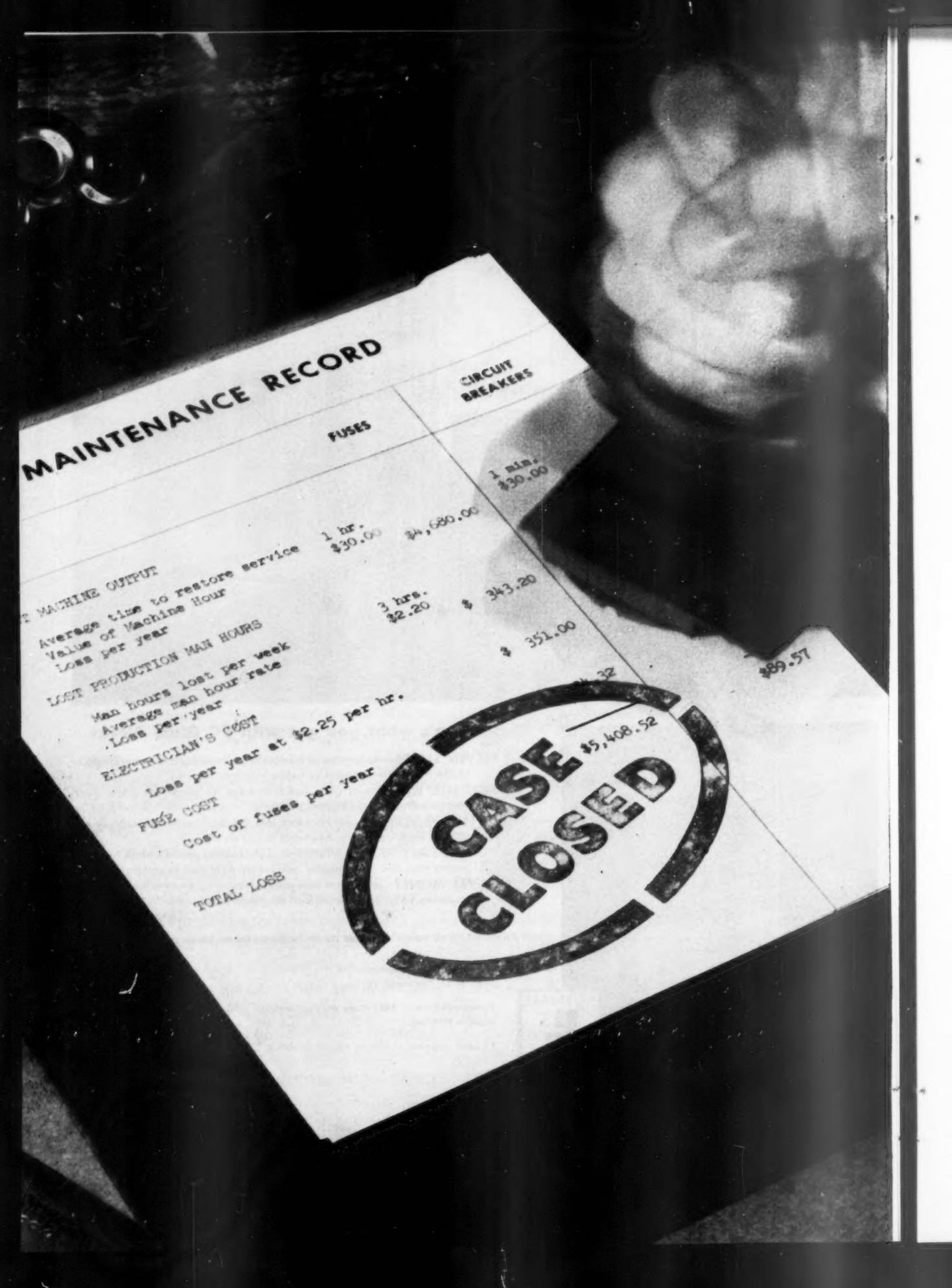
MAINTENANCE RECORD
FUSES
CIRCUIT BREAKERS
1 min. $30.00
T MACHINE OUTPUT
Average time to restore service 1 hr. $30.00 $4,680.00
Value of Machine Hour
Loss per year
3 hrs. $2.20 $ 343.20
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Man hours lost per week
Average man hour rate
Loss per year $ 351.00
$89.57
ELECTRICIAN'S COST
Loss per year at $2.25 per hr.
FUSE COST
Cost of fuses per year
$5,408.52
TOTAL LOSS
CASE CLOSED

The case of the—

$5408 MISTAKE

Solution? On normal service interruptions, Westinghouse Circuit Breakers saved up to 98% down time costs

The real cost of fuses is down time. Being nickeled and dimed to death with fuse replacements is only part of the story. This manufacturer* found that total cost of down time, due to outages with fuse protection, was $5408 in a single year. When Westinghouse Circuit Breakers were installed, outage overhead dropped to $89.

Why this great difference? Blown fuses mean idle men—idle machines. Production stops. You lose money until an electrician replaces the fuse.

This costly mistake is being repeated in countless installations. What is unnecessary down time costing you?

With Westinghouse De-ion® Circuit Breakers, a flip of the handle, after a circuit interruption, puts you back into production in an instant—no need to call an electrician. And another plus—Westinghouse Circuit Breakers do not trip on normal overload surges, but ride them out and save you one unnecessary outage after another.

Calibration of Westinghouse Circuit Breakers is exact, tamperproof for the life of the installation, assuring you year-after-year protection against short circuits and dangerous overloads.

Call your Westinghouse Representative or write for the booklets below, Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna.

*Name of company upon request. J-30134

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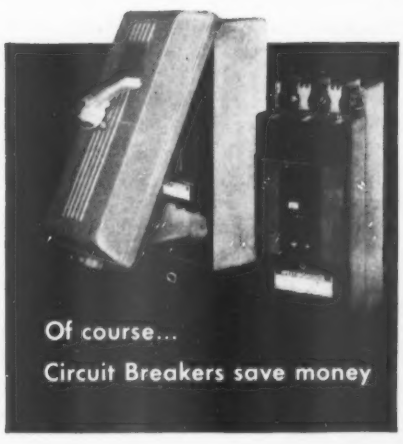

Please send me the booklets checked:

_____B-5407 "AB Circuit Breakers, the Complete Line"

_____B-5456 "Reduce Down Time and Maintenance with AB-I Circuit Breakers"

Name and Title _____

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TENNANT

the Floor Machine that...

Tennant Machine PICKS UP SOILAGE as it cleans. Eliminates scrubbing or scraping; assures better results.

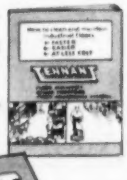
...removes grease-caked grime in 1 operation

Here it is—the one floor machine that *pulverizes and picks up* thick hard grime in 1 operation—and does it dry. It's the TENNANT Industrial Floor Machine.

Operated by one man, it cleans a 16" path . . . shears off and picks up grease-caked dirt at the rate of 8 to 20 lbs. per minute.

SAVES MANHOURS; AIDS TRUCKING

Its powerful high speed drum also smooths and levels . . . assures a clean, dry, smooth-surfaced floor for fast, easy trucking. 16", 12" and 8" models, gas or electric.



Write for illustrated bulletins.

G. H. TENNANT CO.
2554 N. 2nd St.
Minneapolis 11, Minn.

TENNANT
Established 1870

INDUSTRIAL FLOOR MACHINES

Six guideposts to the "labor mind" show you . . .

Why Labor Leaders Act That Way

By WILLIAM H. PETERSON • Polytechnic Institute of Brooklyn

Is there such a thing as the "labor mind"? In any literal sense, of course, it must be admitted there *isn't*. Individual labor leaders vary greatly, think differently, express themselves differently. Yet there are certain common factors that exert great influence on great numbers of union officials—local as well as national and international.

This article outlines six of the most important of these common factors. They won't give you a one-way ticket to understanding everything labor leaders do. But you *will* get some illuminating glimpses into what makes these men tick.

1. Rival unionism fosters fear and aggression. Hardly any union leader feels completely secure in his bargaining position with the company. The impact of rival unionism is only one of the reasons for this state of mind. But it is an important one.

Not infrequently unions find themselves competing for recognition with other unions affiliated with the same international labor organization—AFL or CIO, as the case may be. To add to the competition, both AFL and CIO have active and aggressive organizing committees and unions in the same fields. To name a few such fields: government, aircraft, automobile, footwear, textile, electrical. And there are quite a few cases where AFL and CIO are bucking established independent unions.

Jurisdictional arguments and charges of raiding are understandably common under such conditions. Employers, caught in the middle, all too often end up as the target of all the hostility.

Is it surprising, under these circumstances, that labor leaders are worried about being accused of "knuckling under" to managements by rival unions? Indeed not. It's one basic reason for hard bargaining. As one local union president told me:

"Perhaps I do drive too hard a bargain. But if I don't, the next guy will."

2. Rank-and-file pressure creates unrealistic bargaining demands. Are you ever puzzled by seemingly "crazy" demands by union officials who are normally pretty sound and conservative? Don't be surprised. It's one natural outcome of the peculiar relationship between the officials and the rank-and-file.

Labor leaders tend to absorb some of the employer's viewpoint after a few years of negotiating contract terms. They come to realize in many instances that there is a saturation point in a company's ability to pay. In a word, they usually tend to become more conservative at the bargaining table with the passage of time. Responsibility also has a sobering effect. Age—and surveys show how vastly older the leaders are than the membership—has mellowed the leaders.

Turn the page

LABOR LEADERS

Begins on page 262

But now consider the rank-and-file. The average worker is generally more youthful and demanding. Removed from the business side of the bargaining picture, unschooled in economic realities, he has an elastic concept of corporate revenue.

"If they're taking in millions in sales, why can't they shell out quarters for improvements?" said a picket to a Pittsburgh newspaper man during the steel strike. That's a typical view.

Another factor: Most union constitutions require that membership demands, duly voted on, be included in the formal union demands. When that happens, the leader has no choice but to include "pie in the sky" demands with a straight face. He may not like requests for "a 30-hour week," "overtime on overtime," "pensions at age 55," and the like, any better than you do. But he has to "fight" for them just the same.

It's wise to distinguish between purely rank-and-file pressure demands and those that arise out of planned bargaining strategy. Some extreme demands aim to encourage the well-known and long-cultivated practice of compromise and give-and-take in bargaining. As Lloyd Reynolds of Yale once heard a labor leader put it:

"Every year I sell the closed shop for a nickel."

Management *can* and *does* play this same game. I recently heard of a Bridgeport (Conn.) manufacturer who yielded on dues checkoff by the company for the union's concession of a 5% increase in work-load assignments. Astute bargaining is not an attribute solely of the labor mind.

3. Worker resentment is encouraged as a leadership tool. To lead, and to have that leadership backed by paid-up dues, labor leaders must have the ability to "deliver the goods." But many feel they need something more.

The gap between labor and

Tennant Model 36 Power Sweeper sweeping floors in famed turbo-jet plant of A. V. Roe Canada Ltd., Malton, Ontario.

...does the work of a CREW

Due to EXCLUSIVE engineering features, one TENNANT Power Sweeper usually replaces a 3 to 12-man pushbroom crew . . . and does a far cleaner sweeping job besides.

This explains why so many firms have *fleets* of several TENNANT Sweepers. Each machine promptly *pays for itself* in labor costs alone, usually in 90 days or so. And, thanks to superb construction, they stay on the job . . . usually for *years.*

THESE FEATURES CUT SWEEPING COSTS

Speed and maneuverability are expertly combined in a TENNANT Sweeper . . .

Instant reverse avoids hand shifting; one pedal for forward and reverse.

"On-a-dime" turns mean faster work in tight corners.

Large capacity, exceeds 90,000 sq. ft. per hour . . . covers 36" to 48" path. Gas or electric. (Smaller model sweeps 24" path.)

WRITE TODAY for free "Cost Savings Graph" for estimating possible savings with mechanized sweeping. Also illustrated bulletins on sweeper performance.

Tennant Electric Sweeper is quiet, dependable, sweeps full shift on one charge.

Tennant "24" Sweeper is fast and streamlined . . . ideal for narrow aisles. Big sweeper features.

TENNANT Established 1870

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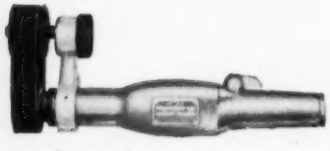
HEAVY-DUTY INDUSTRIAL
POWER SWEEPERS

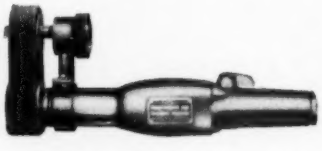
TWO NEW BUCKEYE
Belt Grinding Attachments
FOR CLOSE QUARTER WORK

Now—you can save up to 50% on grinding costs, even on close quarter work where every inch of free space counts! These two NEW Buckeye Belt Grinding Attachments are specifically designed for grinding on concave contours and confined areas.

The BGA-12 and BGA-24 models provide the same economy, efficiency and fine finish as the standard BGA-21 and BGA-42 models, PLUS extra maneuverability for working in close quarters. Choose now from four models . . . select the Buckeye BGA that meets your grinding requirements exactly.



BGA-21 2" diameter contact wheel mounted on tool spindle.



BGA-12 2" diameter contact wheel mounted on idler spindle.

BGA-42 4" diameter contact wheel mounted on tool spindle.

BGA-24 2⅜" diameter contact wheel mounted on idler spindle.

• *what are you waiting for?*

In just two minutes, you can write for Bulletin S-13 and get complete information on all four models, any one of which can help you cut production time and costs.

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DIVISION 13 • DAYTON 1, OHIO

Portable Air and Electric Tools for Industry

IN CANADA: Joy Manufacturing Co. (Canada) Ltd., Galt, Ontario

LABOR LEADERS

Begins on page 262

management must be well established, they feel. Labor peace is wonderful, but seldom permanent—else how could a union justify its existence? Thus is latent resentment exploited.

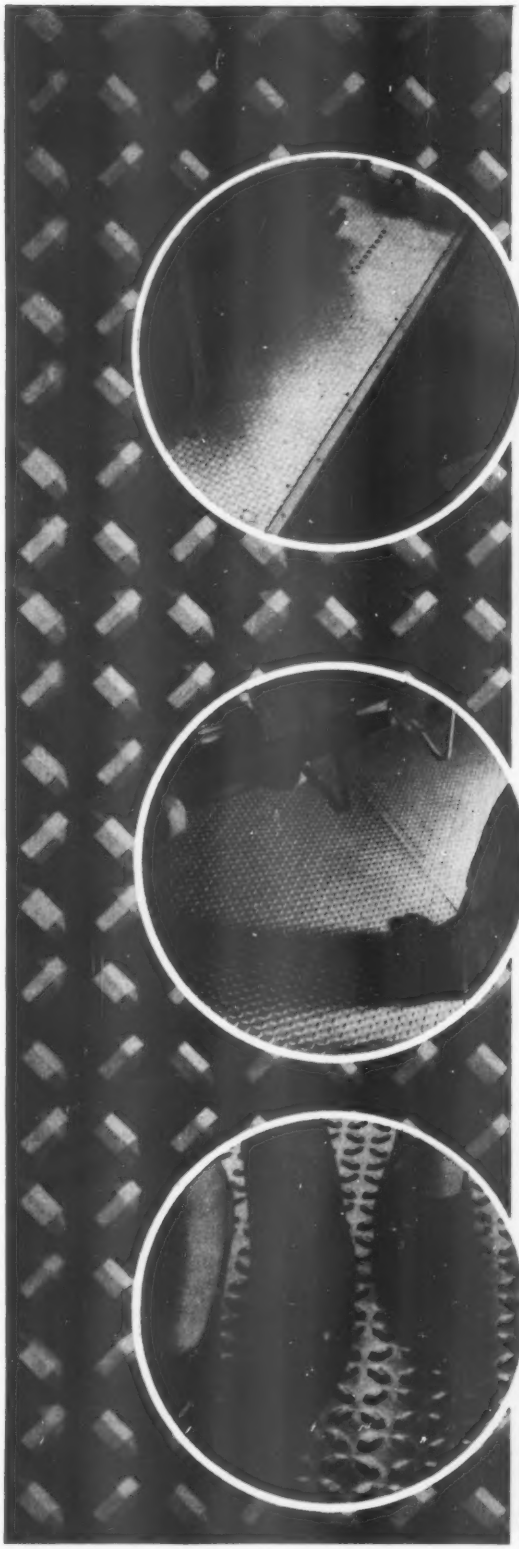
Where there's the will, it's easy enough to stir up trouble. Almost any element of the work situation can give rise to complaints at some time. Even such a relatively innocuous situation as the assigning of work stations can cause conflict. To aggravate such problems is not difficult.

But not all of this is coldly deliberate, by any means. Often it is an automatic reaction, reflecting a basic point of view long since accepted. Thus the leader will indict management for things clearly beyond its control. He re-channels the whole system of communication. And in so doing, he re-colors and re-instils it with labor philosophy. Thus he sets up two sharply divided "classes," each with separate lines of communication, separate loyalties and disciplines.

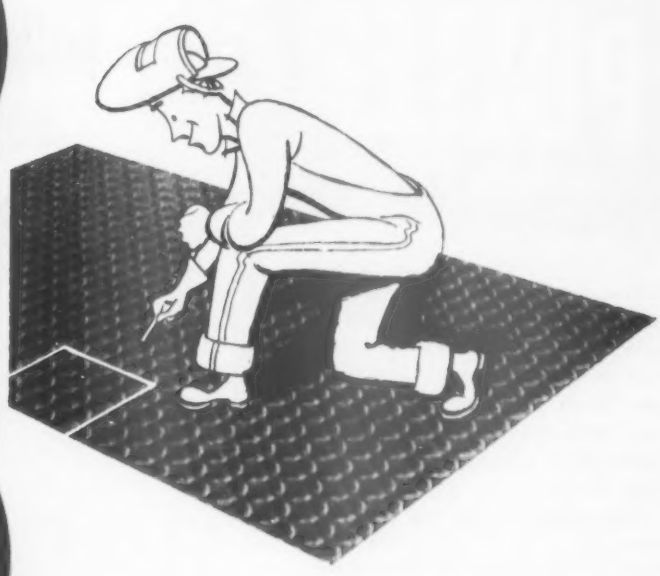
In some cases, the once-willing worker with mild union leanings becomes as a result the now-willing union member with unwilling work leanings. In other words, the labor leader seeks to have the rank-and-file member identify himself with the union. Management seeks to have the worker identify himself with the company. It becomes a tug of war. To see proof of labor's seriousness, look at the union publications. Compare them with your own employee magazine.

There are many ways in which the typical labor leader becomes "Big Brother," plays on latent fears, and "protects the workers from corporate exploitation." For example: constant emphasis on the unbalance of power in collective bargaining; references to the lone worker whose career is at the whim of a capricious foreman, or to the power of the company to install a new machine and fire a whole shop; etc.

Turn the page



You can cut and join this floor plate to any shape you need,
And Multigrip will fabricate with utmost ease and speed;
For Multigrip is so designed to make the sections match
Placed end to end, or side to side, or in a side-end patch . . .
The pattern that is formed will be the same from all directions,
And Multigrip needs fewer joints for it comes in bigger sections!



EASY FABRICATION. The symmetrical pattern of U·S·S Multigrip Floor Plate allows neat, continuous installations and keeps cutting waste to a minimum. Available in long, wide sections, it reduces installation costs where large areas are to be covered.

Slip-proof Multigrip provides firm, sure footing for workers and positive traction for vehicles. The scientifically-designed risers feel comfortable underfoot . . . tend to lessen fatigue. The lozenge-shaped, evenly-spaced risers are at right angles to one another . . . form no pockets to catch dirt, grease and water, no gutters to trap vehicle wheels.

For entire factory floors or steps and platforms of machinery, for safety's sake use Multigrip, the non-skid, permanent floor plate.

UNITED STATES STEEL CORPORATION, PITTSBURGH
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
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U·S·S multigrip

FLOOR PLATE

Sold by leading distributors from coast to coast

3-45

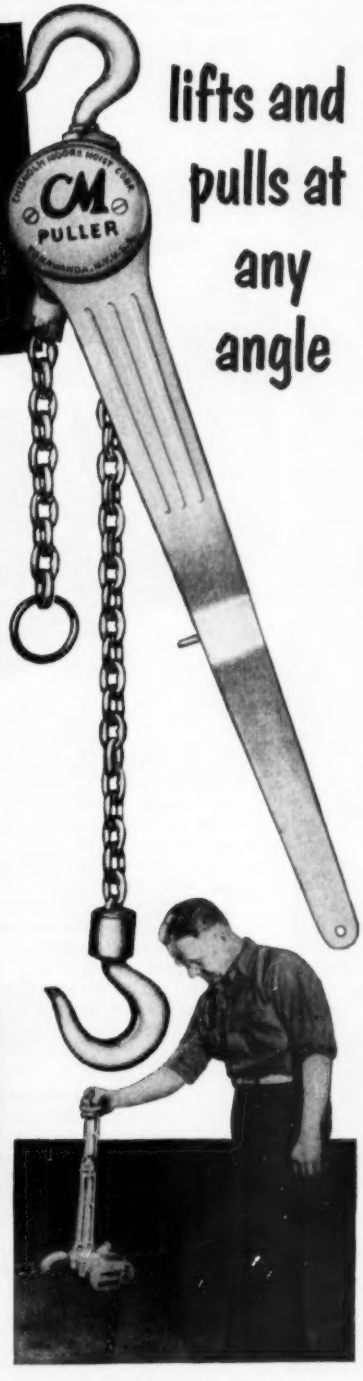
UNITED STATES STEEL

The tool with 1001 uses

Moving machinery, pulling boiler tubes, joining belts, setting pipe, lifting motors and for untold other uses nothing is so handy as the CM Puller. Light weight, compact and inexpensive. Takes but a minute to put into service. Eliminates slow, and often dangerous, makeshift methods.

CM PULLER

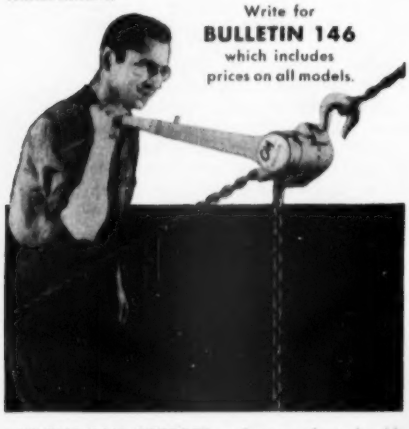
CAPACITIES: ¾ TO 6 TONS



lifts and pulls at any angle

Operated by a ratchet handle, requiring little more effort than an automobile jack, objects up to 12,000 lbs. can be lifted or pulled vertically, horizontally, or at any angle. Sturdy and dependable for long service. FAST—Free wheeling permits quick adjustment of load chain. AUTOMATIC BRAKE—Holds load at any point. LIGHT WEIGHT—Easily carried. ¾ ton model weighs only 13 lbs. "HERC-ALLOY" LOAD CHAIN—For maximum strength and flexibility in use. LIFETIME LUBRICATED—No attention required. Simple, fully enclosed mechanism.

Write for **BULLETIN 146** which includes prices on all models.



ANYONE CAN OPERATE and every plant should have several of these inexpensive CM PULLERS handy for the general maintenance crews.

Ask your CM Distributor to show you the CM PULLER

CHISHOLM-MOORE HOIST CORPORATION

(Affiliated with Columbus McKinnon Chain Corporation)

GENERAL OFFICES AND FACTORIES: TONAWANDA, N. Y.

SALES OFFICES: New York • Chicago • Cleveland

LABOR LEADERS

Begins on page 262

Is it surprising, then, that most labor leaders resent any voluntary benefits management may wish to give to workers? To labor, this is far more than just going over the leader's head. It strikes at the very basis of his existence, he feels. Knowing that his is a political as well as an economic organization, he fears his members may question the need for a union if the company comes through without compulsion. There is no good reason to expect thanks for "favors" voluntarily given. That is not the way of the labor mind.

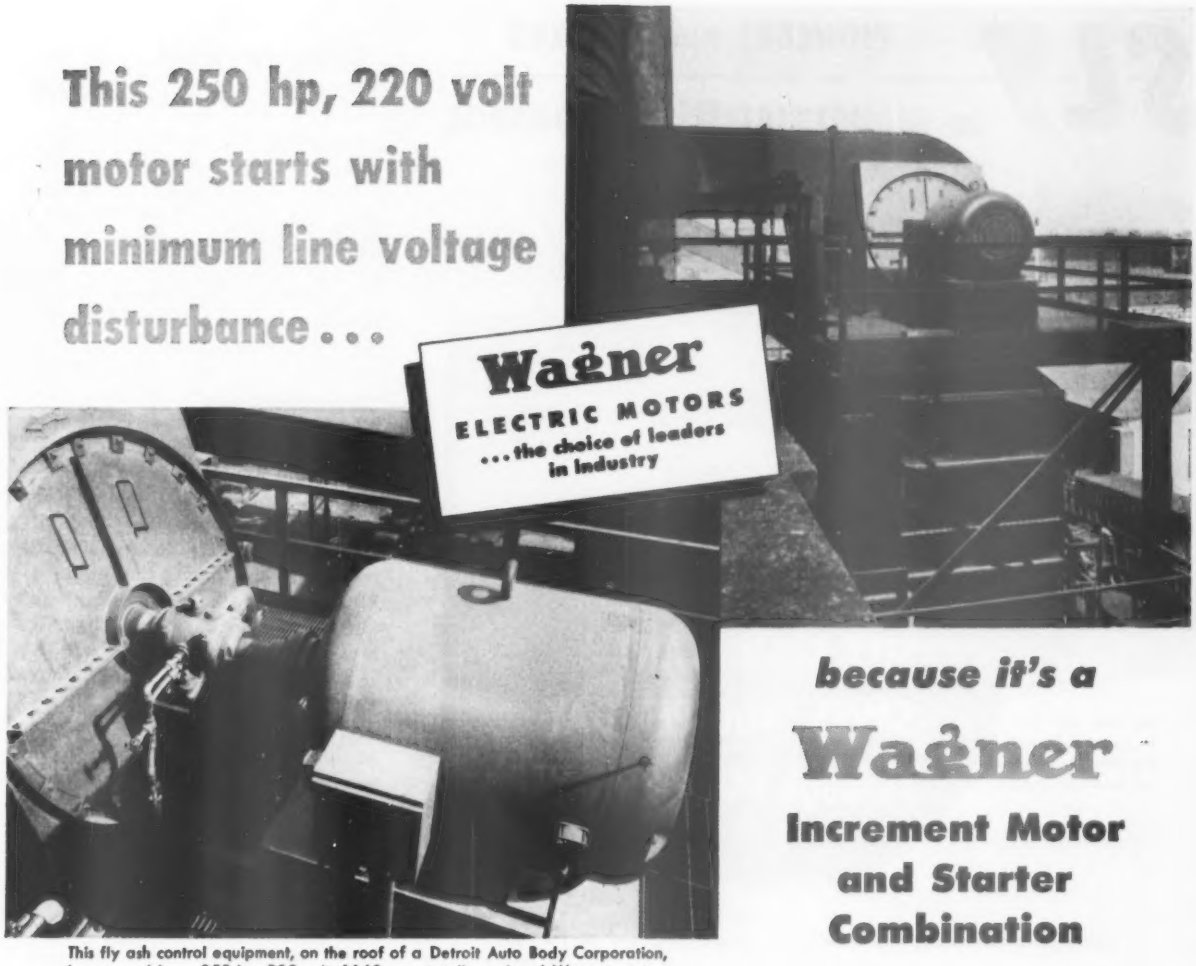
4. Fear of responsibility blocks genuine cooperation. This is not always true, of course. But it's the common pattern. As has already been pointed out, the labor leader naturally falls into the role of critic. When he becomes even half-responsible for company policy, it seems unnatural to him. He feels uneasy, fears that cooperation may be misinterpreted as collusion.

In addition, co-determination of labor policies carries with it another great disadvantage to the labor leader. That is the assumption of risk of failure of those policies.

The famous Naumkeag cooperative experiment in New England during the 1930's is a good example. The experiment was between the Naumkeag Company and the United Textile Workers, AFL. The result of cooperation in setting production standards was a serious breach between the leaders of the union and the membership. A wildcat strike took place. This led Sumner H. Slichter to write:

". . . Out of such situations have grown many tragedies of union leadership. . . . The union leader who has great foresight and is devoted to the long-run interests of his members is likely to be accused of becoming too close to the employer, even of selling out to him. The irony of it is that the leader's very devotion to the

This 250 hp, 220 volt motor starts with minimum line voltage disturbance . . .



This fly ash control equipment, on the roof of a Detroit Auto Body Corporation, is powered by a 250 hp, 220 volt, 1160 rpm, totally-enclosed Wagner motor.

because it's a Wagner Increment Motor and Starter Combination

The part-winding increment motor and starter combination (pioneered by Wagner) provides an economical method of starting polyphase squirrel-cage motors for any application where reduced current draw at start is required or desirable. No auto-transformers or resistors are necessary.

Voltage disturbances on the line are reduced because current taken from the line is not broken during the starting period—as is the case when auto-transformers or compensator-type starters are used.

You benefit when you install a Wagner increment motor and starter "package" because you get a highly efficient, most economical, motor and starter combination that limits inrush of motor current to values that are acceptable to most power companies for all or parts of their distribution systems.

* * *

When you standardize on Wagner Motors—you get the advantages of a liberal warranty . . . of nationwide service facilities, with on-the-spot service, replacement motors and parts available from 25 Wagner-owned Service Branches and more than 750 Authorized Service Stations. You can choose from a wide variety of types and sizes (from 1/125 to 400 hp.) Bulletin MU-185 gives complete information—write for your copy. Bulletin MU-128 gives full information on Wagner Increment Motor and Starter Combinations.

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BRANCHES IN 32 PRINCIPAL CITIES

M53-6

SLY PIONEERS and LEADERS in INDUSTRIAL DUST CONTROL

Soy Bean Mill. Two large double file Sly Dust Filters handling soy bean meal dust.

SOY BEAN PLANT SAVES $400 PER DAY Through DUST RECOVERY

Because of the meal dust created in processing soy beans, this company* included Sly Dust Filters, as standard equipment five years ago, in its original layout.

The Sly Filters collect 5½ tons of soy bean meal *daily*, at a value of upwards of $400. Not only is the company highly pleased with these savings but also with the resulting cleanliness of its plant. Filter maintenance has been insignificant.

In crushing, shredding, pulverizing, loading, packaging, operations—in various process industries—dust is created. If valuable, the dust can be reclaimed profitably. Even if the dust has no value its collection pays off in cleaner plants, better working conditions and reduced costs.

Expertly designed and built, Sly Dust Filters offer many advantages in greater filtering capacity, easier bag replacement, automatic control, and other features which spell low cost operation.

MAY WE TELL YOU MORE ABOUT SLY FOR YOUR PARTICULAR APPLICATION?

*Name upon request.

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New York • Chicago • Philadelphia • Syracuse • Detroit • Buffalo
Cincinnati • St. Louis • Minneapolis • Birmingham • Los Angeles • Toronto

LABOR LEADERS

Begins on page 262

interests of his members is the reason for their suspicion."

Small wonder that "cooperation" is honored more in lip service than in practice!

5. Politics dominates labor thinking. To the labor leader, fighting rival unions is bad enough. But the competition does not stop there. Every union official is a politician, ever facing the next election. Internal opposition is almost always present—carping and criticizing.

Union politicians, too, look at the record. This provides a hard incentive to exact the highest possible price in bargaining—to deliver the goods today, regardless of tomorrow.

True, in many unions, "machines" have cemented themselves in office. Yet the success of any machine—whether John L. Lewis' or New York City's Tammany Hall—is measured by the "benefits" received by the electorate. Campaign oratory is important, but tangible results in the pay envelope are more so.

What does all this imply? Just this: Managements are anxious to know if there are any limits to bargaining demands. The answer, practically speaking, is *yes* for the short run, and *no* for the long run.

6. Opportunism dominates labor strategy. Modern labor leaders are sophisticated men. They talk with ease and persuasiveness of such complex concepts as productivity, cost-of-living indexes, gross national product, purchasing power, and guaranteed annual wages. Demands are clothed in new and challenging dress.

Why? Because such intellectual-sounding economic talk is good strategy. It helps dignify what otherwise would look like inconsistency or fence-jumping opportunism. "Increased purchasing power" can be used, for example (with the support of elaborately economic argument),

WEBB

Conveyors

✓ Increase Production Efficiency . . .

✓ Improve Shipping Schedules . . .

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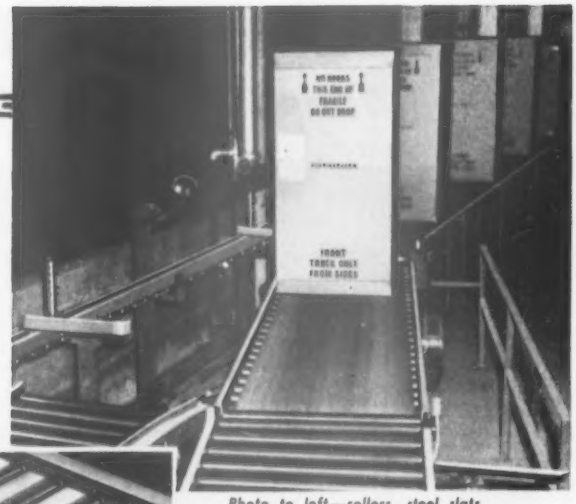


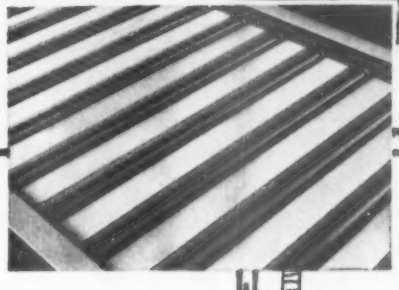
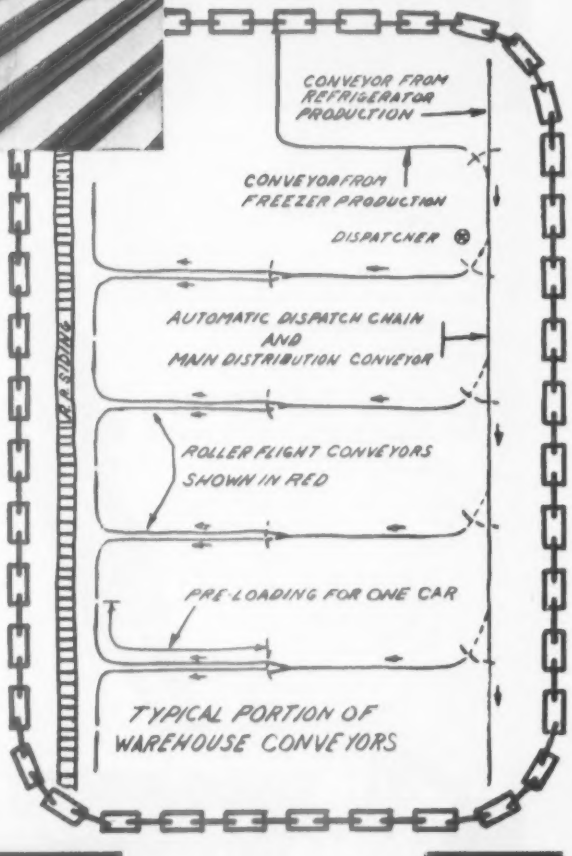


Photo to left—rollers, steel slats and Webb rivetless chain construction of Roller Flight Conveyors

for

Refrigerator Manufacturer


CONVEYOR FROM REFRIGERATOR PRODUCTION
CONVEYOR FROM FREEZER PRODUCTION
DISPATCHER
AUTOMATIC DISPATCH CHAIN AND MAIN DISTRIBUTION CONVEYOR
ROLLER FLIGHT CONVEYORS SHOWN IN RED
PRE-LOADING FOR ONE CAR
TYPICAL PORTION OF WAREHOUSE CONVEYORS

This efficient Jervis B. Webb conveyor system for mechanically and automatically handling refrigerators and freezers in a well known manufacturer's large warehouse has eliminated previous storage and shipping problems. Warehouse has storage capacity of 130,000 refrigerators and a shipping capacity of 100 cars per day.

The conveyor system basically is a roller type main distribution conveyor with an automatic dispatch chain running the length of the warehouse, and 10 cross conveyors which extend from it to the shipping dock. To permit preloading of each cross conveyor with a complete carload of refrigerators or freezers, a gravity transfer switch is installed at the point where conveyor divides as illustrated in sketch.

Proper application and skillfully engineered installation of roller conveyors, belt conveyors, roller flight conveyors, electronic eyes, limit switches, transfer switches, etc., assure positive control for automatic movement of refrigerators and freezers. Approximately 600 tons of conveyor material were installed to provide a complete system that will automatically dispatch 7 units per minute to any predetermined storage point in the 320,000 sq. ft. warehouse or to any of the 20 loading stations on the shipping dock.

Conveyor Engineers and Manufacturers

Send for fully illustrated catalog that provides complete information on Webb floor type conveyors.

OFFICES IN PRINCIPAL CITIES • FACTORIES IN DETROIT, LOS ANGELES, HAMILTON, ONTARIO

KELLER Air Tools
Speed TV Assembly

ANOTHER EXAMPLE OF
KELLER *Air Tools engineered to industry*

Keller Screw Drivers and Nut Setters, conveniently mounted in "scabbards" along the edge of the workbench, have reduced the cost of assembling these TV sets 50% or more.

FACTS IN BRIEF
ABOUT KELLER PNEUMATIC SCREW DRIVERS

Weigh less

Interchangeable parts

Consume less air

Wide variety of handles, gearing, torques, speeds

Need less "back-up" in the tool room

Reduce operator fatigue

Attachments, clutches, finders, and bits, for every purpose

Send for
FREE 36-Page Booklet
for more information and interesting ideas on air tool application

Keller Tool Company, Grand Haven, Mich.
Please send me a free copy of your booklet on Pneumatic Screw Driving and Nut Setting Tools

Name _____ Title _____
Company _____
Address _____
City _____ Zone _____ State _____

LABOR LEADERS

Begins on page 262

to "curb inflation," or to "prevent depression." Take your choice. Or opportunism may take other directions.

For example, the 1949 mild recession made further union demands for outright wage increases look incongruous. Yet it was precisely at that time that the United Steelworkers launched their successful drive for noncontributory pensions.

These are not isolated examples. They are a basic evidence of one major characteristic:

Like all minds, labor's must save face, must have some rational basis on which to justify its attempts to get what it wants when it wants it.

* * *

Where will labor stop? An answer was supplied by Samuel Gompers when he was asked about AFL's aims. He said: "More and more and more—now." Earlier, when facing a Senate investigating committee, Adolph Strasser, a spokesman for AFL, summed up this policy:

Question: You are seeking to improve home matters first?

Answer: Yes, sir, I look first to the trade I represent; I look first to cigars, to the interests of men who employ me to represent their interest.

Chairman: I was only asking you in regard to your ultimate ends.

Witness: We have no ultimate ends. We are going on from day to day. We are fighting only for immediate objects.

"The interests of the men who employ me," "fighting for immediate objects," "I look first to the trade I represent,"—these statements, particularly when viewed in the perspective of time and the labor leader's compulsion to union elections, evidence the never-ending drive for "more and more." It follows that there can hardly be a permanent plateau of satisfaction in labor relations. **The labor leader must keep on delivering the goods.**

Cut Your V-Belt Costs Right Now!

—this test tells how!

If you want longer V-Belt wear and lower V-Belt costs just make this simple test. Bend any V-Belt that has *straight sides* and—as it bends—*feel* the sides bulge out! (See Fig. 1-A, below)

This out-bulge forces the belt to press unevenly against the V-pulley and of course wear on the belt is concentrated where it bulges most. Naturally this shortens the life of a *straight-sided* V-Belt.

Now, make this same test with the belt that is built with *concave sides*—the Gates Vulco Rope!

See the difference? There is no *out-bulge!* The precisely engineered concave sides *fill out* and become *perfectly straight.* They now *exactly fit* the sheave groove and therefore *press evenly* against the V-pulley. This distributes all wear *uniformly* across the *full width* of the Gates Vulco Rope. And this means longer belt life and *lower belt costs* for you.

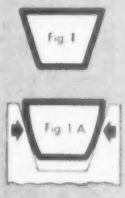
Only V-Belts made by Gates are built with concave sides. Whenever you buy V-Belts, be sure that you get the V-Belt with Concave Sides—the Gates Vulco Rope!

Gates Engineering Offices and Jobber Stocks are located in all industrial centers of the United States and in 71 foreign countries.

Multiple engines and generators were installed to supply power during the development of Chicago, Wilmington and Franklin Coal Company's Waltonville, Illinois, Coal Mine. The engines had to be connected to the generators with a drive that would absorb vibration and also be completely reliable—so these Gates V-Belts were installed. Mr. Rodenbush, Superintendent, says, "The Gates Vulco Rope Drives have been entirely satisfactory in every way."

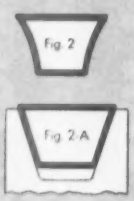
What Happens When a V-Belt Bends

Straight-Sided V-Belt



How a Straight-Sided V-Belt Bulges In the Sheave-Groove. Sides Press Unevenly Against the V-Pulley, Causing Extra Wear at Point Shown by the Arrows.

Gates Vulco Rope With Concave Sides



The Concave Sides Fill Out to Precise Fit in Sheave-Groove. No Side-bulge! Sides Press Evenly Against the V-Pulley —Uniform Wear and Longer Life!

CS-531

Gates® VULCO ROPE DRIVES

THE GATES RUBBER COMPANY • DENVER, U.S.A.

V-Belts — Hose
Molded Rubber Goods for Industry
World's Largest Maker of V-Belts

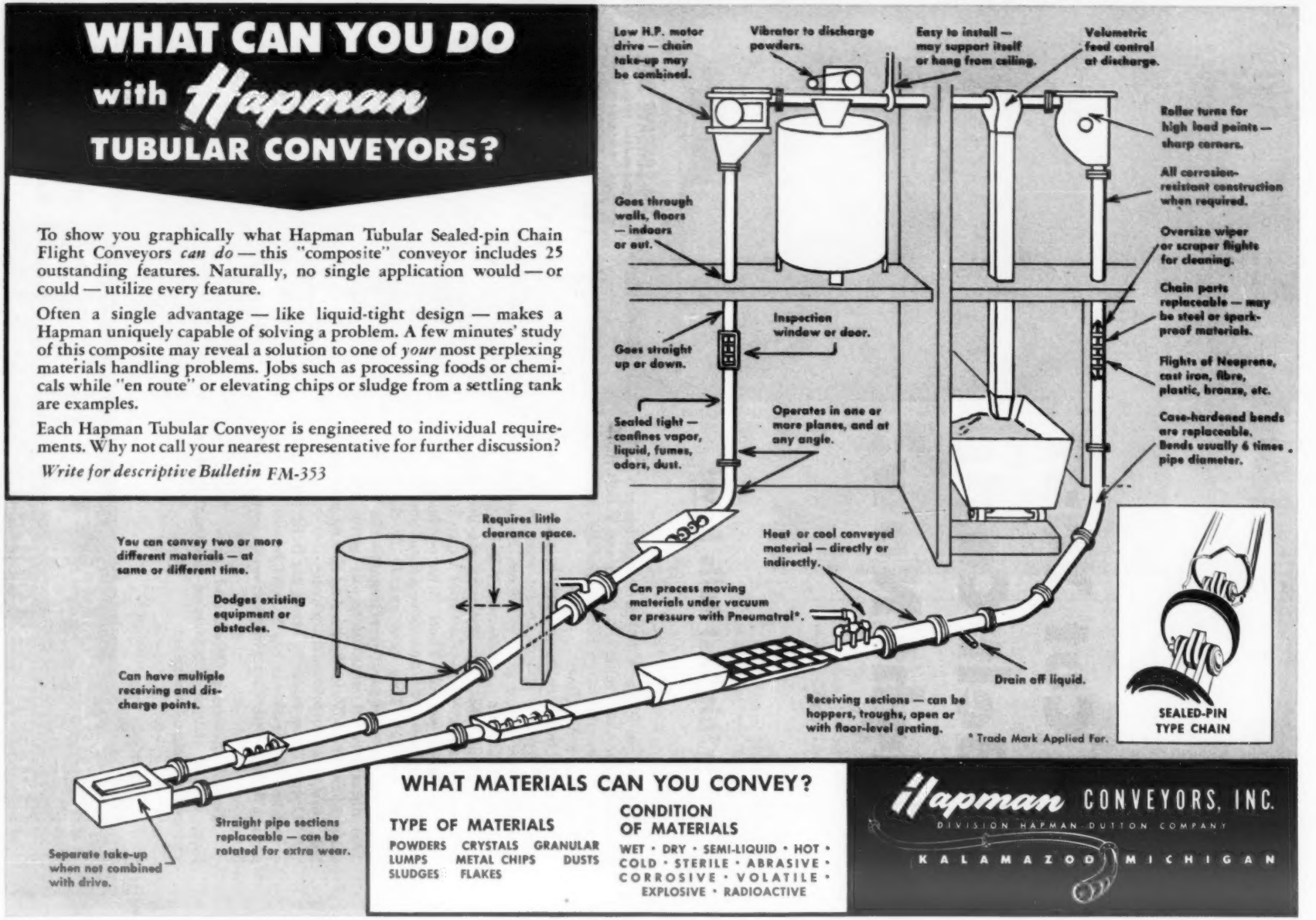
WHAT CAN YOU DO with Hapman TUBULAR CONVEYORS?

To show you graphically what Hapman Tubular Sealed-pin Chain Flight Conveyors *can do* — this "composite" conveyor includes 25 outstanding features. Naturally, no single application would — or could — utilize every feature.

Often a single advantage — like liquid-tight design — makes a Hapman uniquely capable of solving a problem. A few minutes' study of this composite may reveal a solution to one of *your* most perplexing materials handling problems. Jobs such as processing foods or chemicals while "en route" or elevating chips or sludge from a settling tank are examples.

Each Hapman Tubular Conveyor is engineered to individual requirements. Why not call your nearest representative for further discussion?

Write for descriptive Bulletin FM-353


Low H.P. motor drive — chain take-up may be combined.
Vibrator to discharge powders.
Easy to install — may support itself or hang from ceiling.
Volumetric feed control at discharge.
Roller turns for high load points — sharp corners.
All corrosion-resistant construction when required.
Goes through walls, floors — indoors or out.
Oversize wiper or scraper flights for cleaning.
Chain parts replaceable — may be steel or spark-proof materials.
Inspection window or door.
Goes straight up or down.
Flights of Neoprene, cast iron, fibre, plastic, bronze, etc.
Sealed tight — confines vapor, liquid, fumes, odors, dust.
Operates in one or more planes, and at any angle.
Case-hardened bends are replaceable. Bends usually 6 times pipe diameter.
Requires little clearance space.
You can convey two or more different materials — at same or different time.
Heat or cool conveyed material — directly or indirectly.
Dodges existing equipment or obstacles.
Can process moving materials under vacuum or pressure with Pneumatrol*.
Can have multiple receiving and discharge points.
Drain off liquid.
Receiving sections — can be hoppers, troughs, open or with floor-level grating.
Straight pipe sections replaceable — can be rotated for extra wear.
Separate take-up when not combined with drive.
SEALED-PIN TYPE CHAIN

* Trade Mark Applied For.

WHAT MATERIALS CAN YOU CONVEY?

TYPE OF MATERIALS

POWDERS · CRYSTALS · GRANULAR · LUMPS · METAL CHIPS · DUSTS · SLUDGES · FLAKES

CONDITION OF MATERIALS

WET · DRY · SEMI-LIQUID · HOT · COLD · STERILE · ABRASIVE · CORROSIVE · VOLATILE · EXPLOSIVE · RADIOACTIVE

Hapman CONVEYORS, INC.

DIVISION HAPMAN-DUTTON COMPANY

KALAMAZOO MICHIGAN

A Century MOTOR With Gas Mask PROTECTION

Underwriters Approved

EXPLOSION PROOF MOTORS

Take a look at these Century Explosion Proof Motor features:

- Vital motor parts protected — sealed into inner frame.
- Motor can be reversed without changing direction of the fan — fan runs in either direction.
- Uniform ventilation surrounding outside of inner frame.
- Smooth, straight-through ventilating passages.
- Winding electrically insulated 6 different ways.
- Unusually free from vibration.
- Ball bearing housing keeps grease in — dirt out — lubricated for several years' normal service, with grease plugs for additional lubrication, if necessary.
- Easy-to-remove fan guard is held securely in place with two screws.
- Smooth exterior surface is easy to clean.
- Cast iron frame with integrally cast feet resists rust and corrosion — even when mounted in places where processed materials may contact the feet.
- Rugged construction gives generous safety factor for rough handling.

CE-760

Your property and employees are protected, because this Century Explosion Proof motor is totally enclosed—sealed to prevent a motor spark from causing an explosion.

Class I, groups C and D are used in atmospheres containing flammable gases or vapors: Ethyl ether vapors, gasoline, petroleum, napthha, alcohols, acetone, lacquer solvent vapors and natural gas.

Class II, groups E, F and G are used in atmospheres containing combustible dusts: Metal dust, carbon black, coal or coke dust and grain dusts.

Naturally, corrosive or abrasive materials in the air are also sealed out of the vital parts.

For your protection, specify Century motors on new equipment or for replacement. Your nearby Century Distributor will be glad to give you full information on the complete line of Century motors—from 1/8 to 400 horsepower. We are limited in some sizes of the Explosion Proof motor.

Century C MOTORS

CENTURY ELECTRIC COMPANY

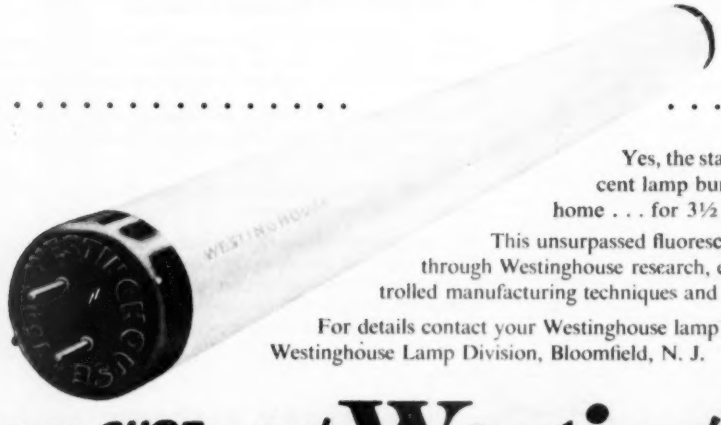
1806 Pine Street • St. Louis 3, Missouri

Offices and Stock Points in Principal Cities

HE'LL GROW FROM THIS

TO THIS

BEFORE YOUR WESTINGHOUSE FLUORESCENT LAMP BURNS OUT



Yes, the standard Westinghouse Fluorescent lamp burns many years in the average home . . . for 3½ years in an office or factory.

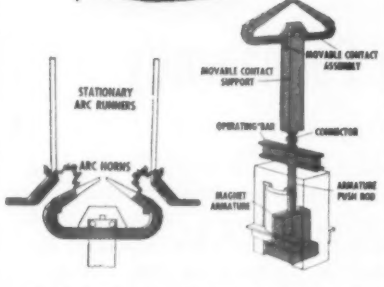
This unsurpassed fluorescent lamp life span is achieved through Westinghouse research, engineering, and carefully controlled manufacturing techniques and processes.

For details contact your Westinghouse lamp supplier or write to Westinghouse Lamp Division, Bloomfield, N. J.

YOU CAN BE SURE...IF IT'S Westinghouse

TYPE 256

CUT Maintenance Cost



Double-break contacts, vertical action, dual blowout structure and other features speed arc extinction . . . assure long life and low maintenance.

IF YOUR OPERATION demands frequent starting, inching, reversing or plugging . . . if rough repetitive duty plays havoc with contacts and sends maintenance costs skyrocketing . . . you need the Allis-Chalmers Type 256 Air Contactor.

No Turning Shafts — No Shaft Bearings

The elimination of turning shafts, shaft bearings and flexible contact leads minimizes mechanical wear. Double-break contacts of arc resistant alloys, *operating in air,* straightline vertical action and fast arc extinction add months of contact wear. Actual case histories of "once-a-minute interruption" duty have revealed little contact wear in a full year's operation.

Replacement Units

Compact design permits installation in a cubicle used for oil immersed units in existing starters. And, of course, the Type 256 Air Contactor is also available in Allis-Chalmers Type H Starters.

Call your nearby A-C representative or write for Bulletins 14B7303 and 14B6410. Allis-Chalmers, Milwaukee 1, Wisconsin.

A-3945

A-C ALLIS-CHALMERS

ALLIS-CHALMERS

YOU MUSTN'T MISS—

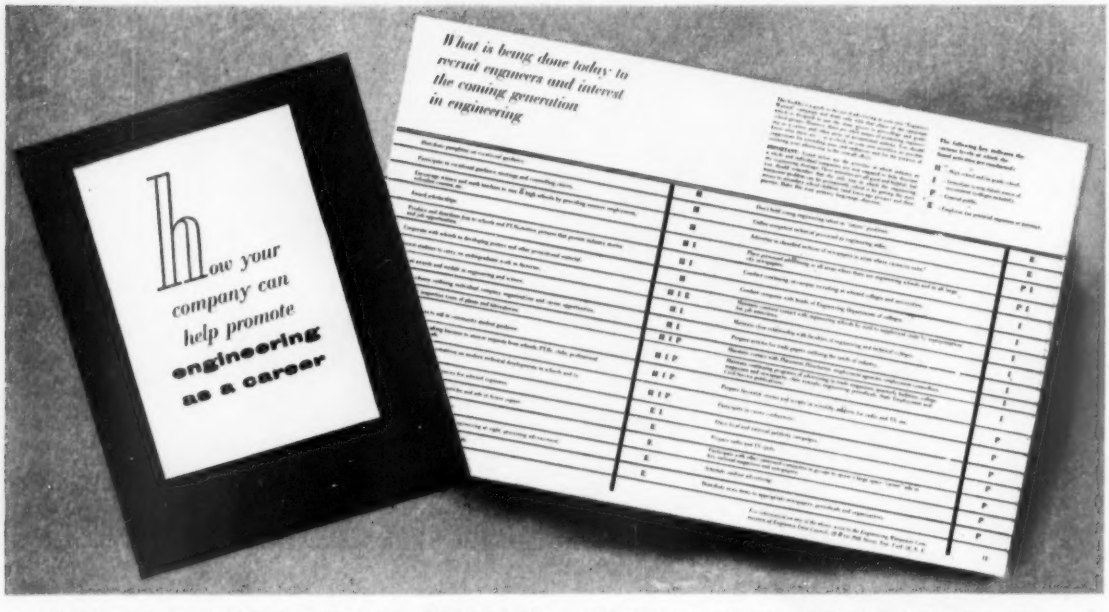
INDUSTRIAL NEWS

INDUSTRIAL NEWS, BEGINNING ON THIS PAGE

TIMELY HINTS TO BETTER MANAGEMENT ON PAGE 288

QUOTES FROM INDUSTRY'S LEADERS ON PAGE 296

IDEAS TO STIMULATE YOUR THINKING, ON EVERY PAGE


How your company can help promote engineering as a career
What is being done today to recruit engineers and interest the coming generation in engineering

BOOKLET DESCRIBES HOW YOU CAN HELP YOUR COMPANY AND YOUR COUNTRY—BY DOING WHAT ITS TITLE SAYS.

Ending the Engineering Shortage Permanently

You can take part in one of the biggest—and most important—industrial recruitment programs of all time.

It's the drive, now going into high gear, to get more young people interested in engineering as a career. That's the only way to solve the engineering shortage permanently, says the Engineering Manpower Commission of Engineers' Joint Council, New York.

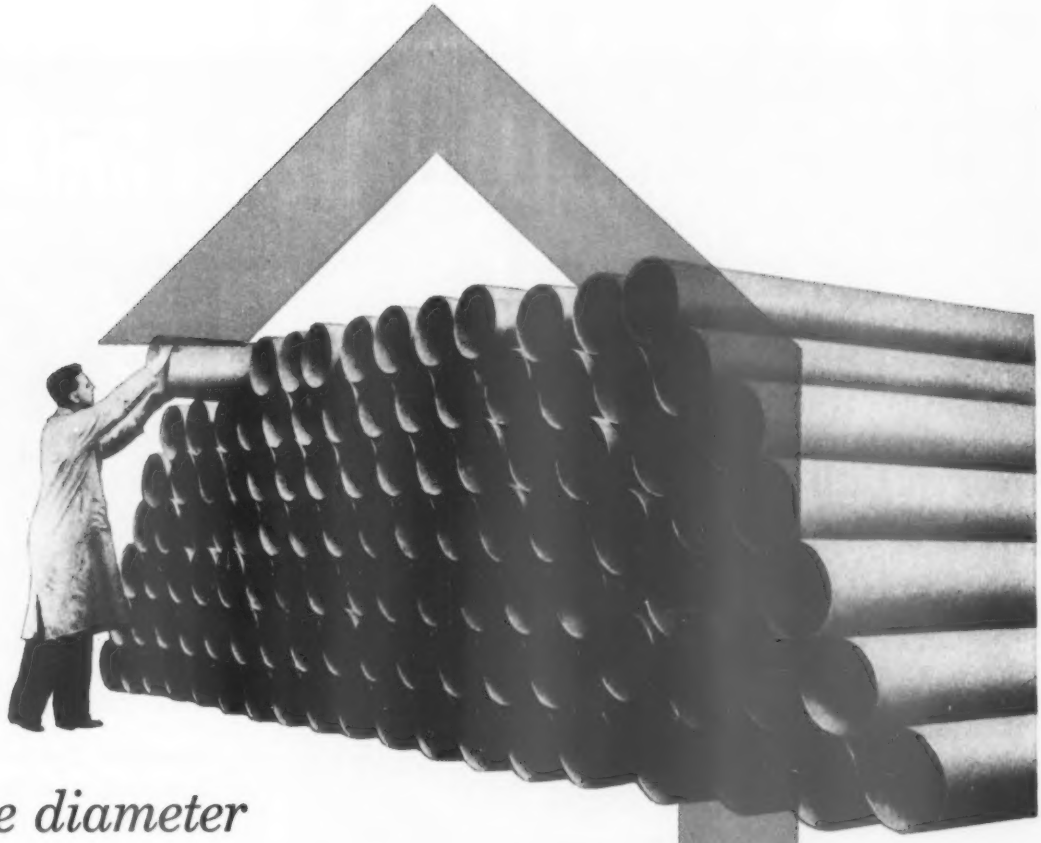
Lots of companies are already helping relieve the shortage by educating pre-college students to the advantages of engineering. But, says EMC, a more aggressive campaign is desperately needed. This year government and industry alone need about 35,000 more engineers than are available.

To help interested companies redouble their efforts, the Advertising Council has prepared for EMC the handbook reproduced in part above.

It lists 36 ways companies can plan for tomorrow's engineering needs today. It tells how you can learn more about each. It provides material you can use in advertising campaigns to attract high school students to engineering.

You can get a free copy of the booklet by writing Advertising Council, Inc., 25 W. 45th St., New York 36.

Turn the page



Large diameter

TRENTWELD STAINLESS TUBING

for your requirements

TRENTWELD Large Diameter Stainless Steel Tubing meets precisely the tubing requirements of fabricators, designers and manufacturers of processing equipment. Available in diameters of 4″ to 40″ OD, TRENTWELD is precision-finished with absolutely uniform section. TRENTWELD is furnished in any finish, for fabrication with any fittings you select. Call on us.

CONDENSING LOOPS FOR HANDLING MERCURY VAPOR AT A WESTERN MINE. FABRICATED OF CR-NI STAINLESS STEEL.

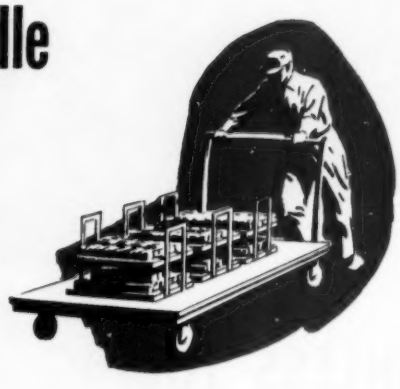
TRENTWELD

STAINLESS STEEL TUBING

TRENT TUBE COMPANY, GENERAL SALES OFFICES, EAST TROY, WISCONSIN (Subsidiary of CRUCIBLE STEEL COMPANY OF AMERICA)

"Manhandling" materials

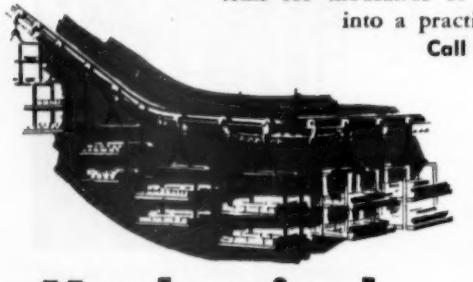
can manhandle your profits, too



A poorly planned, inadequate materials handling system can move profits right out of your plant.

The right mechanical handling and processing system must be keyed to your products, the components, their fabrication and assembly. The experience of 34 years—all we have learned in designing, engineering and building completely mechanized systems for thousands of leading plants—goes into a practical solution for you.

Call in the MHS engineer!



Mechanical Handling Systems, Inc.

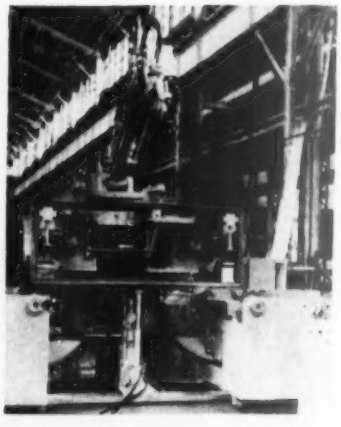
4608 NANCY AVENUE, DETROIT 12, MICH.

Offices in Principal Cities

In Canada: **Canadian Mechanical Handling Systems, Ltd.**

YOU MUSTN'T MISS—

Begins on page 276



WHAT IT TAKES to speed production on appliance cabinets and liners.

Machine Combines Forming and Welding

Here's further help in combining operations to speed production (FACTORY, April 1952, p. 86): a machine that forms and welds in a single automatic sequence. It's now being used by three companies to cut costs on fabricating a wide range of appliance cabinets and liners.

According to Struthers-Wells Corp., Titusville, Pa., and Federal Machine & Welder Co., Warren, Ohio, which jointly developed it, the device has:

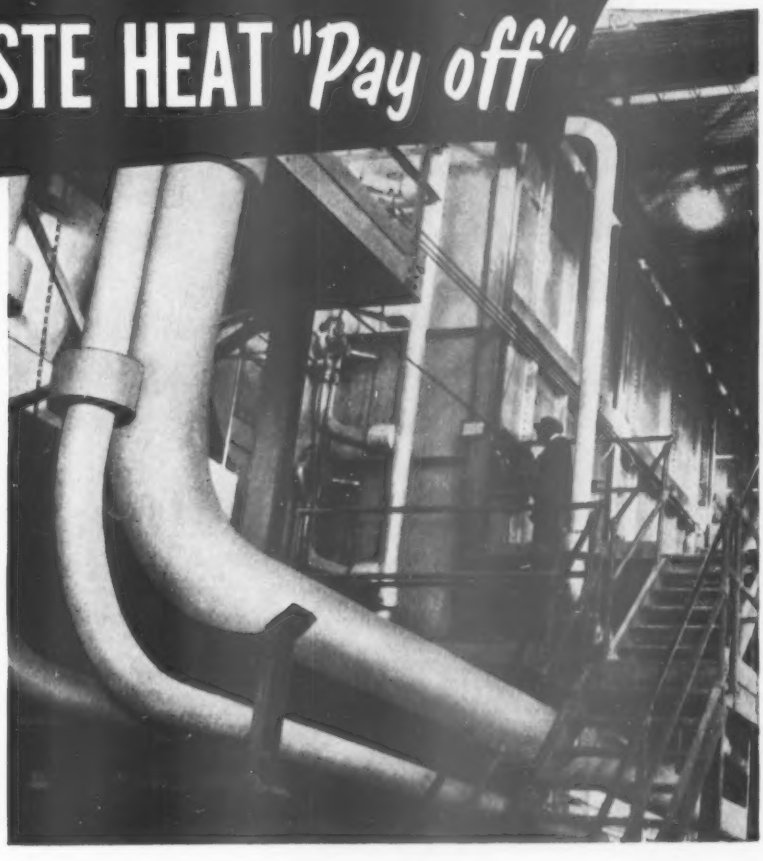
- Cut production costs. You don't have to transfer to a separate welding station. And you need only one operator to perform both operations.
- Saved valuable floor space. Not only is the floor space occupied by the welding machine eliminated, but also the large areas required to store unwelded assemblies.
- Eliminated sizing fixtures. The die forms of the bending machine act as perfect sizing and holding fixtures.

The machine · It consists of a Struthers-Wells Quadruplex tangent bender with a Federal

MAKING WASTE HEAT "Pay off"

with

the help of K&M insulations



One of the East's large cement companies gets all the electric power it needs for plant operation by utilizing the waste heat from its cement kilns. This heat is first directed to a boiler which produces a continuous supply of 700°F. steam. This, in turn, is piped to a power-generating turbine—and that's where K&M insulations come in!

So that heat loss is held to a minimum, two effective K&M insulations have been used in combination on the main steam header: a 1½" layer of "Featherweight" 85% Magnesia over a 1½" layer of Hy-Temp insulation. For two smaller boiler-feed water lines, a 1½" layer of "Featherweight" 85% Magnesia is sufficient. All pipes have been finished with a canvas jacket and painted.

K&M "Featherweight" 85% Magnesia is a versatile, dependable, economical insulation for applications up to 600°F. Combined with Hy-Temp, it is efficient on installations having temperatures up to 1900°F. Both materials are supplied in a wide variety of forms and thicknesses.

Your K&M distributor, an experienced applicator, will gladly answer your questions about these products and their uses. Call on him soon, or write to us for complete information.

Nature made Asbestos . . . ***Keasbey & Mattison***
has made it serve mankind since 1873

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA

In the Yard or in the Plant...

EUCLID'S "pace" the Assembly Line

Euclid Cranes prove an important link in the chain of operations required to convert incoming materials into outgoing products in a vast number of manufacturing plants. Facility of movement through ease of precision control enables "Euclids" to handle a large variety of production operations, and to readily "pace" the assembly line. Write us concerning your crane problems. We'll be pleased to submit a proposal.

EUCLID CRANES AND HOISTS Raise Profits

THE EUCLID CRANE & HOIST CO. 1364 CHARDON ROAD EUCLID, OHIO

FARADAY

since 1875

the Emblem of Quality

in signals and systems

UNI-PACT BELL #2000

You want the best there is—from a simple push button to a complex signal system. For more than 77 years Faraday has supplied home and industry with the finest electrical equipment. Consult your electrical wholesaler for details on the complete Faraday line.

HOLTZER-CABOT **FARADAY** STANLEY & PATTERSON

CONSOLIDATED BY:

SPERTI FARADAY INC. ADRIAN, MICH.

BELLS · BUZZERS · HORNS · CHIMES · VISUAL AND AUDIBLE PAGING DEVICES AND SYSTEMS

YOU MUSTN'T MISS—

Begins on page 276

Machine & Welder welding component mounted on a beam. You raise and lower the beam with each machine sequence to make the forming operation possible.

The bender forms the cabinet to the desired shape. The last bender operation actuates a limit switch that initiates the automatic welder cycle.

Throatless Press for Giant Forgings

A new development in forging press design makes possible monster hydraulic presses with 100,000-ton capacity and more. That's several times the capacity of today's biggest conventional model presses.

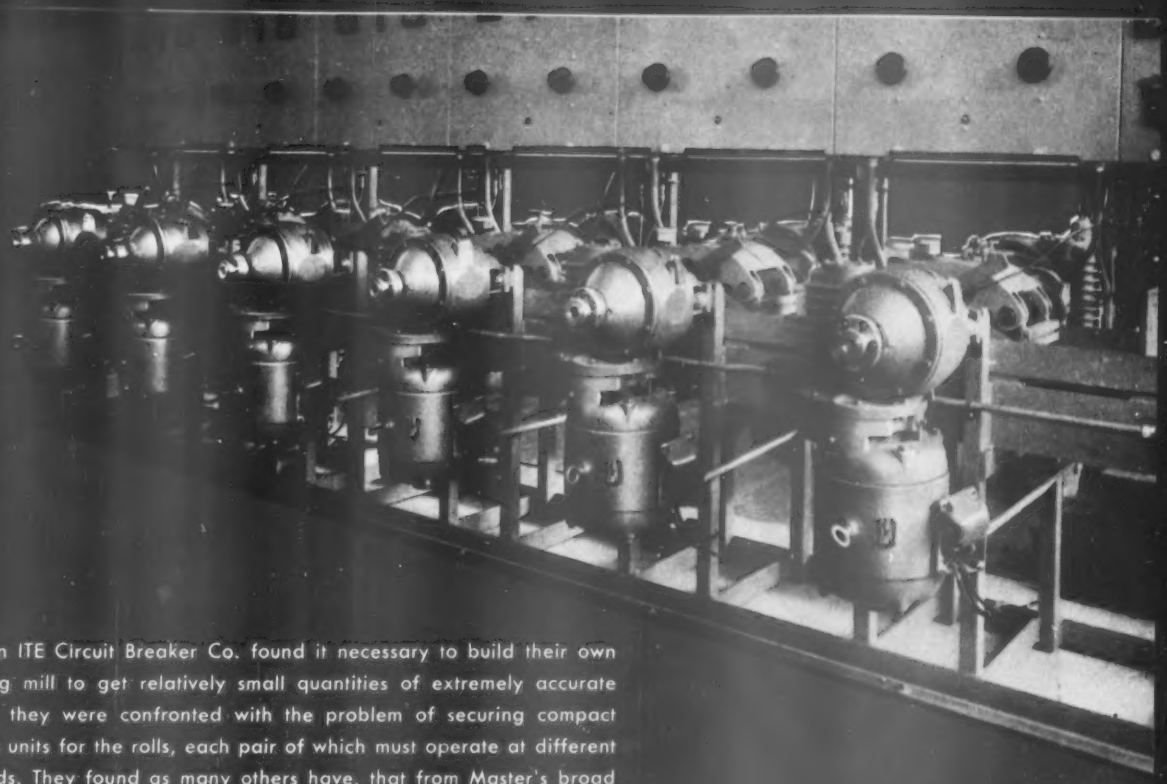
Major advantages of the throatless presses, as they are called:

- They will forge-piece aircraft members much larger than any conventional presses. Savings to the Air Force in man-hours and materials would be very large.
- They can be built with existing machine tools and construction equipment. In contrast, conventional presses of even 50,000-ton capacity would require specially built tools and equipment.
- They will provide 360-deg. access for placing ingots and removing dies and work of any size. With high-capacity conventional presses, access to the press bed is limited.

How it works · The throatless press does not have a tension member to connect press head and bed. Instead there's a massive, monolithic concrete structure that provides all the necessary housing, support, and suspension.

The maker, Throatless Press Co., Cleveland, is a new company, that was organized to pioneer the field.

Turn the page



When ITE Circuit Breaker Co. found it necessary to build their own rolling mill to get relatively small quantities of extremely accurate strip, they were confronted with the problem of securing compact drive units for the rolls, each pair of which must operate at different speeds. They found as many others have, that from Master's broad line of Gearmotors they could select standard units which would give them the RIGHT horsepower, the RIGHT shaft speed in one compact unit that they could use RIGHT where they wanted it.

Probably you will never design a rolling mill. But the next time you need motor drives for your plant or product, remember that Master Motors, available in thousands and thousands of types and ratings, give you a selection you can get nowhere else.

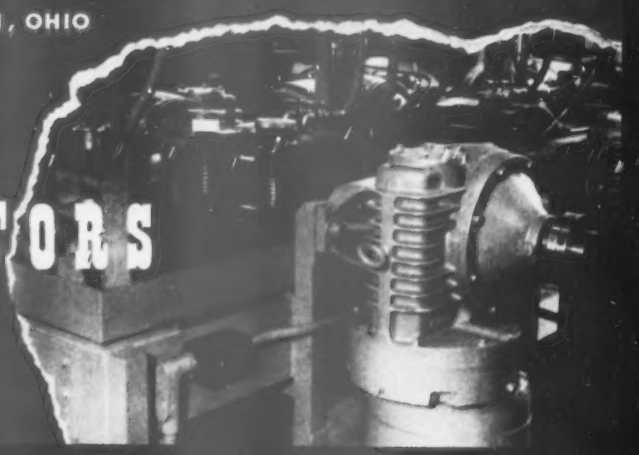
tough problem . . . easy solution

Open, enclosed, splash proof, fan-cooled, explosion proof . . . horizontal or vertical . . . for all phases, voltages and frequencies . . . in single speed, multi-speed and variable speed types . . . with or without flanges or other special features . . . with 5 types of gear reduction up to 432 to 1 ratio . . . with electric brakes . . . with mechanical variable speed units . . . and for every type of mounting . . . Master has them all and so can be completely impartial in helping you select the one best motor drive for YOU.

Select the RIGHT power drive from Master's broad line and you can increase the saleability of your motor driven products . . . improve the economy and productivity of your plant equipment.

THE MASTER ELECTRIC COMPANY • DAYTON 1, OHIO

MASTER GEARMOTORS



MR. HOWARD HAVEKOST SAYS:

"For 23 years, I've been working very closely with hundreds of drafting rooms in the territory I serve. My customers have come to depend upon Bruning for practically all of their drafting room needs, and they appreciate being able to get direct-company service and personalized attention."

Mr. Havekost is typical of Bruning's many specialists. These trained men take expert care of all the drafting room requirements for architects, designers, engineers and draftsmen from coast to coast, working from one complete and responsible source of supply.

Wherever you are, consult your Bruning Drafting Room Specialist about your needs. He'll help you save time and money, and see to it that you get top-quality materials.

BE SURE TO ASK HIM ABOUT COPYFLEX, the white-printer that needs no exhaust ducts, gives you dry, ready-to-use prints in seconds.

From Pencil to Print, Only BRUNING HAS EVERYTHING

- COPYFLEX Whiteprinters
- Drafting Machines
- Tracing Papers and Cloths
- Surveying Equipment
- Drafting Furniture
- Drawing Instruments
- Sensitized Papers, Cloths, Films
- Electric Erasers
- Complete line of Supplies and Equipment

MODEL 93 COPYFLEX Finest large volume whiteprinter on the market. Makes ready-to-use prints up to 42" in width by any length. Needs no installation, exhausts or plumbing.

BRUNING
Everything for the Engineer and Draftsman

B-3-1

CHARLES BRUNING COMPANY, INC.
Dept. F-33 Teterboro, N. J.

- ☐ Please have a Drafting Room Specialist call.
- ☐ Send me free booklets on COPYFLEX.
- ☐ Show me COPYFLEX in action (no obligation).

Name.....Title.....
Company.....
Street.....
City.....Zone.....State.....

OFFICES IN PRINCIPAL CITIES

YOU MUSTN'T MISS—

Begins on page 276

Population Estimates for Year 2050

Non one can tell what kind of market your products will have 100 years from now. Maybe no one even cares. Anyhow, this much is certain: There will be lots more people around whose needs you'll have to satisfy.

By 2050, says the Social Security Administration there should be:

- About 380-million Americans, if the birth rate is high, the mortality rate is low.
- About 225-million Americans, if the birth rate is low, the mortality rate is high.

Company's Employees Become Partners

In what is probably the biggest deal of its kind, employees of Cleveland Pneumatic Tool Co. recently became its "owners."

Employees are acquiring ownership through two profit-sharing trusts established for them 3 years ago. One trust for overtime-paid workers will pay off its obligation for 49% of the stock in 7 years. The other, for non-overtime employees, will pay off the balance due for the remaining 51% of stock in 14 years.

A down payment of $2,150,000 will come from funds already in trust. Complete ownership of stock goes to the employees' profit-sharing trust for $11,803,000. Shares are credited to individual employees and go toward building future retirement income. Balance and credit are shown periodically for employees.

In each of the last 3 years, an employee's share of profits was about 20% of base pay. Company officials estimate that profits shared by employees may rise in 1953 to about 35% of the base pay figure.

Turn the page

Which of these PACKAGING IDEAS will cut *your* costs?

- *Reinforced*
- *Waterproofed*
- *Six widths*
- *Easily dispensed by "cut-off" type machines*

Our Industrial Papers Have Solved These Problems!

Can we help *you*?

Stronger Wrap for Big Packs

Angier's new Glass Wrap is reinforced with strong glass fibres to give *better* protection at less cost. Waterproofed; flexible; up to 96" wide.

☐ *Check here for facts.*

Vapor-from-Paper STOPS RUST

Saves greasing metal parts. Saves degreasing. It's Angier VPI® Wrap.

☐ *Check here for facts.*

Center-seam Sealing with Reinforced SNAKE TAPE

It's the *fast* way to seal cartons. And you get a *stronger* closure with only two strips because Snake Tape is reinforced to give strap-like strength! Center-seam sealing is accepted for parcel post, railway express, air express, and truck shipments; it also is accepted for carload and LCL rail shipments where rule 5, section 1 (c) of Uniform Classification applies.

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☑ Check the ideas that interest *you* and send with letterhead to:
ANGIER CORPORATION
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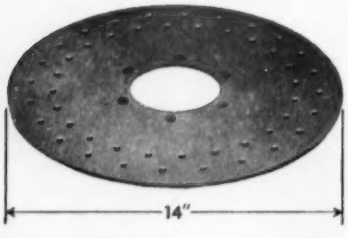
Since 1895 Manufacturers of Industrial Packaging Papers

ELECTRICAL INSULATION THAT CAN BE MADE TO THE SAME TOLERANCES AS STEEL

YES, we *do* mean *any* tolerances that can be produced in steel.

For example:



Two of these 14" Mycalex 400 discs revolve with only .004" clearance. Dimensionally stable, too. Mycalex *stays* accurate.

Mycalex glass-bonded mica is found in *HIGH PRECISION* electrical components.

WRITE FOR ENGINEERING DATA BOOK

SINCE 1919
MYCALEX
THE INSULATOR ®

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Owners of "MYCALEX" Patents and Trade-Marks
Executive Offices: 30 Rockefeller Plaza, New York 20, N.Y.
GENERAL OFFICES AND PLANT
122 CLIFTON BOULEVARD, CLIFTON, N.J.

YOU MUSTN'T MISS—

Begins on page 276

Union Publications Tell What Labor Wants

A good way to learn what the labor unions want from management tomorrow is to keep tabs on the labor publications today. Here's a list of what those demands may be—in terms of both bargaining and legislation—as noted in union periodicals:

1. The guaranteed annual wage.
2. Fair-employment practices legislation on a national state, and local basis. This may result in demands for more non-discriminatory clauses in collective bargaining agreements.
3. More emphasis on organizing white-collar workers.
4. Further legislation requiring higher standards of safety and more equipment.

The information comes from C. T. Spivey, personnel director, Columbia-Geneva Steel Div., U. S. Steel Corp.

One Way to Check Electrolytic Corrosion

There's a new way to lick the problems of electrolytic corrosion when you join copper and aluminum (FACTORY October 1952, p. 122.) Use "sacrificial" pipe joints to take the corrosion load off the aluminum you want to protect.

That's what Alcoa is doing wherever copper meets aluminum in its new Pittsburgh office building. The sacrificial joints are expected to last about 10 or 15 years before they're corroded beyond use. But they'll save a lot of aluminum pipe in the meantime. And they're located in readily accessible spots so they can be easily replaced as needed.

Alcoa has about 650 of these expendable joints throughout the building. They measure a foot long, and up.

Turn the page

GET 19" LIFT from 2½" CLEARANCE!

SIMPLEX
RATCHET LOWERING
JACKS

Lift or Lower the Load Notch by Notch—cannot be Tripped.

With Simplex Ratchet Lowering Jacks minimum toe clearance is necessary. Loads are usually lifted from the ground to the toe of the jack by pinch bars or wedges. Only Simplex Jacks provide equal lift capacity on toe or cap. No other jacks offer such a combination of low cost and all-purpose utility. In fast jacking action—extra-safety features—and rugged strength for longer life, Simplex Ratchet Lowering Jacks give you more for your money! Available in capacities of 1½ to 35 tons. Write today for Bulletin: Industrial 49.

SAFETY SUGGESTION—Use thin wood block—Don't lift or lower steel against steel.

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LEVER · SCREW · HYDRAULIC
Jacks

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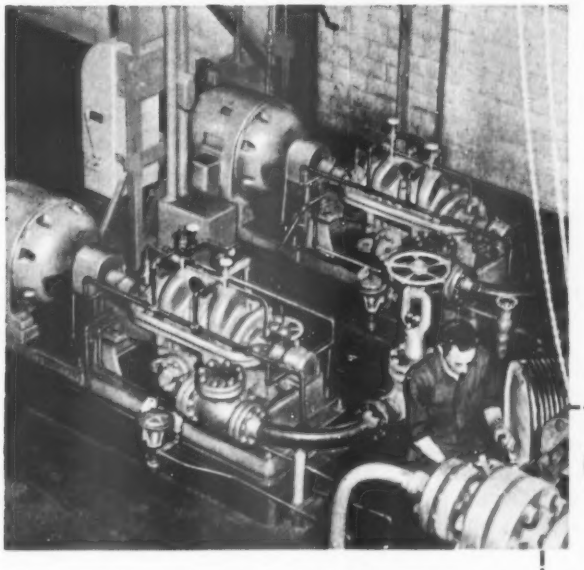
Plastics plant saves $4,000 in one year! *

Read how you, too, can save with . . .

PURE OIL INDUSTRIAL LUBRICANTS



Pure Oil specializes in top-quality industrial oils and greases designed to do several *different* jobs—instead of one specific job.

And to do each job *equally well.*

Regardless of the type of machinery you have in your plant, our industrial engineers can nearly always help you to reduce your lubricants inventory . . . simplify your lubricating procedure . . . minimize waste and error.

Mail coupon today for free "Simplify and Save" booklet giving full details on how to start a labor-saving, money-saving, lubrication program in your plant.

*Oxygen pitting was destroying the high pressure water pumps in General Electric's Coshocton, Ohio, laminated plastics plant. Rod packing had to be replaced every three days. Pure Oil's sales representative suggested adding PUROSOL No. 10 to the water. Result: damage stopped—and a saving of $4,000 a year.

The Pure Oil Company Industrial Sales Dept. F-33
35 East Wacker Drive, Chicago 1, Illinois
Please send me your free "Simplify and Save" booklet.

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Be sure with Pure

Sales offices located in more than 500 cities, including: Atlanta • Birmingham • Charleston • Charlotte • Chattanooga • Chicago Columbus • Indianapolis • Jacksonville • Madison • Memphis • Miami • Milwaukee • Minneapolis • Pensacola • Pittsburgh • Richmond

YOU MUSTN'T MISS—

Begins on page 276

American Know-How Pays Off for Europe

There's plenty of evidence that the export of American industrial know-how is slowly but surely paying off in increased productivity for Western Europe. And it's working to the benefit of American industry as well.

Here's the report of William L. Batt, former minister in charge of the Mutual Security Agency mission to the United Kingdom, on the effect of the long-term Marshall Plan-MSA program in Great Britain:

1. Foundries have tripled their rate of casting manufacture, partly as a result of their findings in U. S. industry.

2. In materials handling, there has been a greatly expanded use of conveyors and fork lift trucks. Much of the increased use is attributed to the report on materials handling made by teams from the Anglo-American Council on Productivity.

3. In diesel engine manufacture, there is new interest in continuous flow production lines.

What's in it for you. There are lots of benefits American industry will get from increased European productivity. The most direct one: Western Europe will make an increasingly better market—already is—for U. S. plant equipment. According to Thomas Robins, Jr., president of Hewitt-Robins, Inc.:

"Foreign countries seeking to emulate American production methods are taking advantage of our conveyor know-how and are buying much equipment in this country."

But higher productivity is slow in coming. Here are some of the obvious reasons why, according to Batt: fear of unemployment, lack of automatic equipment, shortages of raw materials, lack of subcontracting, excessive state control, low rate of capital investment per worker, lack of standardization, and high absenteeism.

Two other factors that make it difficult for European industry to raise its productivity are:

- The conviction of many workers that legislation rather than higher production is the way to achieve a higher standard of living. In many cases, workers simply blame the party in power for their low wages.
- Inadequate use of industrial engineering principles. The expert European machine tool operator, for instance, tends to perform so many related operation that his machine is often idle half the time. As Batt puts it, the French worker now commands about twice as much horsepower as he did when the Marshal Plan began; but he's not making the most of it.

Ighats Protest: How High the Taxes

Don't be surprised if hollering about high taxes gets louder and lasts longer during the next couple of weeks. Income tax time is here and the Ighats are on the warpath, according to the *Wall Street Journal*.

In case you didn't know, Ighat means "I'm gonna holler about taxes." Holler loud enough about them yourself and you, too, become an Ighat. Get the idea?

It's all part of a non-partisan program initiated by Quaker Oats Co., Cedar Rapids, Ia., and picked up by several other companies. Idea is to get as many people as possible to tell senators and congressmen that taxes need to come down.

Plant letter-writing-to-legislators contests and high-cost-of-living displays by storekeepers will tie in with the campaign.

Turn the page

YOU CAN GET ASARCON CONTINUOUS-CAST BRONZES FROM THESE DISTRIBUTORS

AKRON, OHIO—Akron Welding and Spring Co.
940 South High Street
BALTIMORE, MD.—The Gibson & Kirk Company
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CHICAGO, ILLINOIS—Ray M. Ring Co., Inc.
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EVANSVILLE, IND.—Orr Iron Company, Inc.
1100 Pennsylvania Street
FORT WAYNE, IND.—Tools and Abrasives, Inc.
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1125 North Van Buren Street
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NASHVILLE, TENN.—Industrial Bearing Service, Inc.
411 LaFayette Street
NEW ORLEANS, LA.—Standard Brass & Mfg. Co.
2309 Tulane Avenue
N. KANSAS CITY, MO.—Hubbell Metals, Inc.
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PEORIA, ILLINOIS—Ray M. Ring Bearing Co.
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PITTSBURGH, PA.—Pittsburgh Brass Mfg. Co.
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P. O. Box 1469
ROCHESTER, N. Y.—Ontario Metal Supply, Inc.
91 Mount Hope Avenue
ROCKFORD, ILL.—Rockford Tool & Transmission Co.
802 Broadway
SHREVEPORT, LA.—Standard Brass & Mfg. Co.
1557 Texas Avenue
ST. LOUIS, MISSOURI—Hubbell Metals, Inc.
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STRATFORD, CONN.—Ellsworth Steel & Supply Co.
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TOLEDO, OHIO—Williams & Co., Inc.
650 East Woodruff Avenue
WEST COAST—Kingwell Bros., Ltd.
San Francisco and Los Angeles
with broad coverage in 11 western states

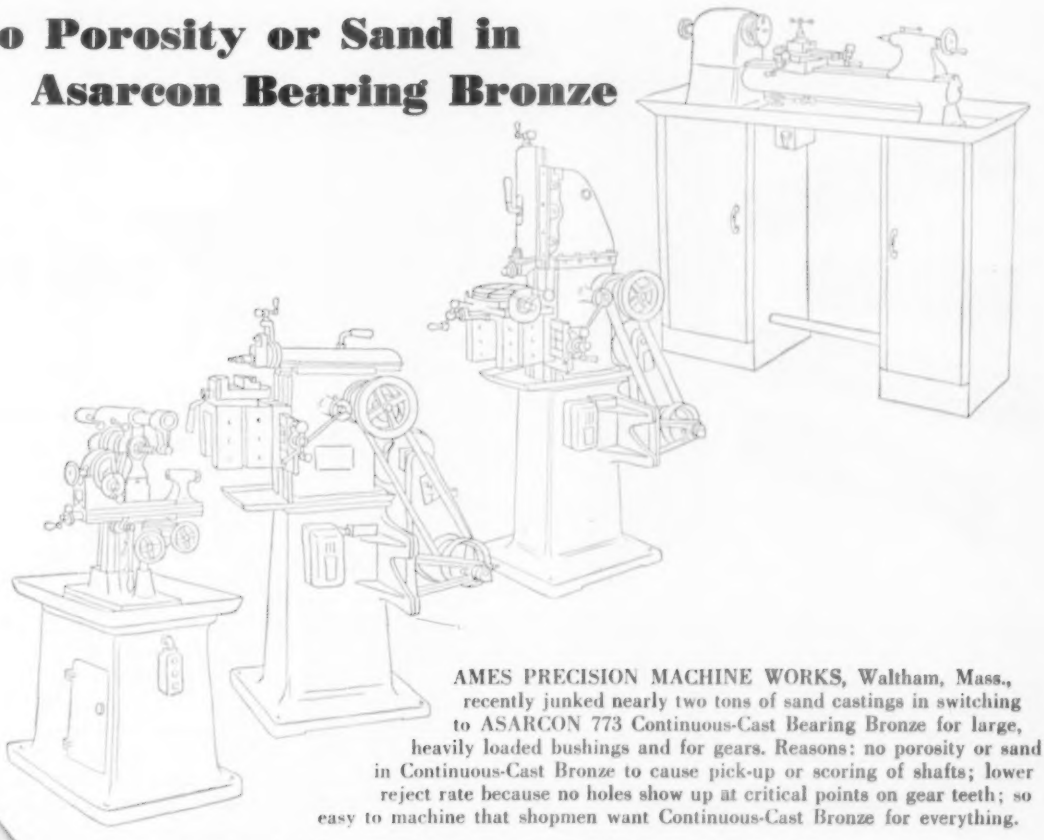
ASARCO CONTINUOUS-CAST RODS-TUBES-SHAPES

American Smelting and Refining Company

OFFICES: Perth Amboy Plant, Barber, N. J.
Whiting, Indiana

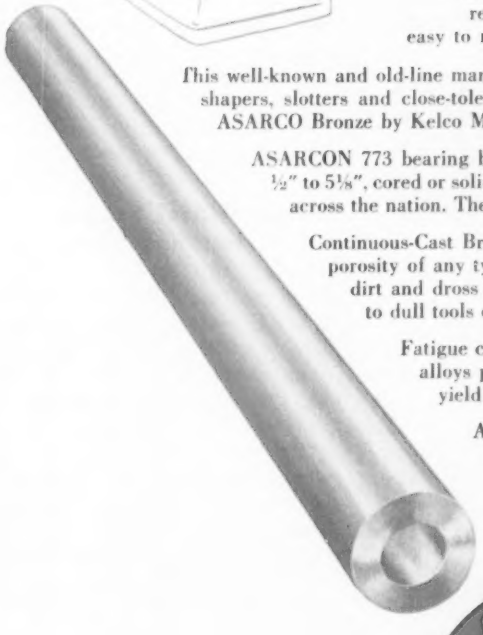
A Customer Reports:

No Porosity or Sand in Asarcon Bearing Bronze



AMES PRECISION MACHINE WORKS, Waltham, Mass., recently junked nearly two tons of sand castings in switching to ASARCON 773 Continuous-Cast Bearing Bronze for large, heavily loaded bushings and for gears. Reasons: no porosity or sand in Continuous-Cast Bronze to cause pick-up or scoring of shafts; lower reject rate because no holes show up at critical points on gear teeth; so easy to machine that shopmen want Continuous-Cast Bronze for everything.

This well-known and old-line manufacturer of precision lathes, milling machines, shapers, slotters and close-tolerance special machinery is supplied with ASARCO Bronze by Kelco Metal Products Company, Boston (distributor).



ASARCON 773 bearing bronze (SAE 660) is continuous-cast in diameters ½" to 5⅛", cored or solid, and is carried in 216 stock sizes by distributors across the nation. They will cut it long or short to meet your specific requirements.

Continuous-Cast Bronze contains no hard or soft spots; no blowholes or porosity of any type. Since sand is not used in the process, and dirt and dross are excluded, there is no surface- or internally-trapped abrasive to dull tools or discourage high cutting speeds.

Fatigue characteristics are up to 100% higher than those of the same alloys produced by other casting methods; tensile strength, yield strength and hardness are appreciably improved, too.

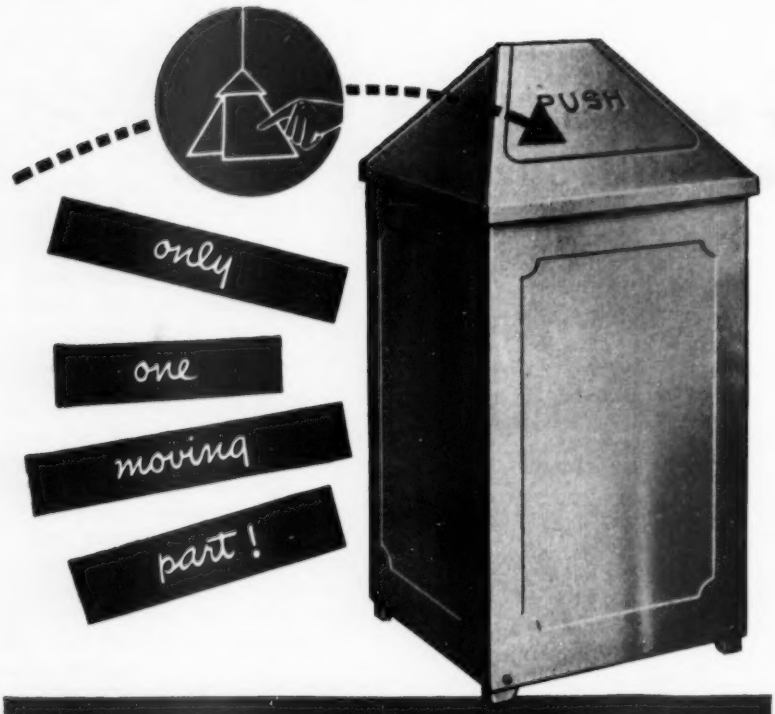
A variety of alloys, longer lengths and special shapes can be cast to order. Write for free catalog containing complete descriptive material.

American Smelting and Refining Company

OFFICES: Perth Amboy Plant, Barber, New Jersey • Whiting, Indiana

ASARCO CONTINUOUS-CAST RODS · TUBES · SHAPES ®

West Coast Sales Agent:
KINGWELL BROS. LTD., 457 Minna Street, San Francisco, California

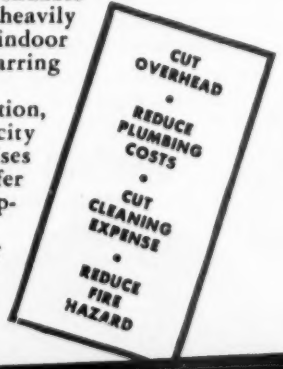


with SOLAR, the original
SELF-CLOSING WASTE RECEPTACLE
No weights! No Springs! No Hinges!

With the Solar Self-Closing Waste Receptacle, the leader in its field for over 25 years, there are no working or moving parts to get out of order. The very simplicity of the swinging top mechanism is its own guarantee to you of dependable performance. Both top and body are heavily reinforced, and the metal legs on the indoor models are rustproof to prevent marring floors.

Whether it is an educational institution, industrial plant, hospital, dairy, a city street, park or building, your premises will always be neater, cleaner and safer with Solar Self-Closing Waste Receptacles.

Buy Solar and you get the best. Your sanitation problem merits the best. Write for additional information today.



SOLAR-STURGES Mfg. Div.
Pressed Steel Car Company, Inc., Melrose Park, Illinois

YOU MUSTN'T MISS—

Begins on page 276

TIMELY HINTS

Survey on Inventory, Production Control

The number of manufacturing plants with inventory or production control systems is increasing fast. But the figures indicate they're still in the minority.

Tag Manufacturers' Institute, New York, offers the information. It surveyed 6000 manufacturers in diversified industries back in 1951. Then it checked the same companies a year later. Here are the 1952 results.

- 19% had both an inventory and production control system, a 7% gain over 1951.
- 24% had only an inventory control system, 3% over 1951.
- 18% had only a production control system, 4% over 1951.

Tight Hotel Space for Handling Show

Going to the big Materials Handling Exposition at Philadelphia's Convention Hall this year? You've still got more than two months before it opens on May 18. But here's some advice: If you don't want to miss out on Philadelphia hotel space for the week-long show, you'd do well to reserve a room for yourself right now.

A preliminary report estimates more than 25,000 visitors will attend. If all are to be accommodated, many will have to stay at hotels in New York and Atlantic City.

For conference information, write Clapp & Poliak, Inc., 341 Madison Ave., New York 17.

Turn the page

IT'S

NATIONAL ELECTRIC

ALL THE WAY!

XDUCT JUNIOR—for stronger, better, more uniform installations. It's electro-galvanized under exacting control that produces a uniform, unbroken zinc coating. The inside is protected by a complete covering of clear enamel that will not crack or break. (½" and ¾" sizes.) Fishes and bends easily. Permanently protects against abrasion, moisture, corrosion.

E.M.T. FITTINGS—a screwdriver is all you need to install these simplified one-piece, precast-steel connectors and couplings. (½" and ¾" sizes.) Steel overlap of screw increases moisture-seams close, accurate fit—making all fittings vibration-proof later . . . Stronger . . . Easy to install in every position.

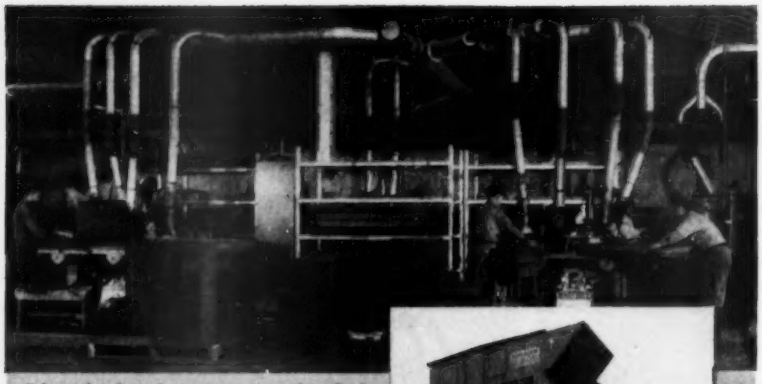
When the job calls for EMT
it pays to go
ALL THE WAY with NE!

Listed by Underwriters Laboratories Inc.

XDUCT JUNIOR ELBOWS—New... National Electric Elbows for E.M.T. (conduit) are packed in strong, well divided boxes for easy handling. Electro-galvanized under the same exacting control as XDUCT JUNIOR Conduit. Both 90° and 45° elbows are available in ½" to 2" sizes. Accurately made for easy fishing.

EVERYTHING IN WIRING POINTS TO

National Electric
PRODUCTS CORPORATION
PITTSBURGH, PA.
3 Plants • 7 Warehouses • 34 Sales Offices



Exhaust hoods and piping, engineered to fit the job, capture dust particles at the source, before they can escape to cause trouble and cost money.

Close-up of Pangborn Collector showing special dust hoppers, dust storage bin and pneumatic discharge duct.

Pangborn presents Woodall* with "DUST to BURN"!

***How Woodall Industries, Inc., uses Pangborn equipment to save $14,000 per year!**

Woodall Industries, Inc., Long Island, N. Y., produces Masonite panels in varying shapes and sizes for the automotive, railroad, television, and refrigeration industries, to name just a few. Shaping and drilling these panels produces Masonite dust—and plenty of it!

Without an effective system of dust control, Woodall workers would soon be knee-deep in dust. Thus, the Pangborn Dust Control System installed at Woodall would be essential at any cost. The beauty of the system, however, is that it *doesn't cost at all*—but actually pays its own way, with a nice profit to boot!

That's because this Pangborn Dust Control System not only maintains a dust-free plant, but also provides *all* the fuel for all heating and processing requirements, by conveying the Masonite dust from its source to a boiler furnace. Savings in oil alone have been figured at about $14,000 a year!

Add to this the savings in "housekeeping" costs, benefits in improved health and morale of employees—and you can see why Woodall is so enthusiastic about their Pangborn Dust Control System.

What are your Dust Problems? Find out what Pangborn can do to solve them. Write today for Bulletin 909A. Address: PANGBORN CORPORATION, 2100 Pangborn Blvd., Hagerstown, Md.

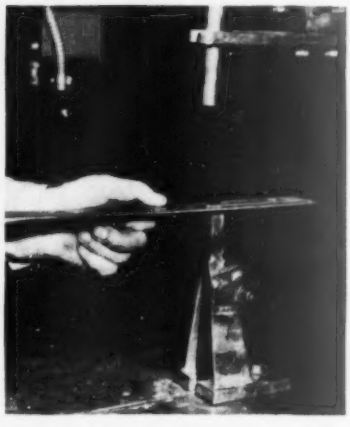
Look to Pangborn for the latest developments in Dust Control and Blast Cleaning equipment

Pangborn DUST CONTROL

STOPS THE DUST HOG from stealing profits

YOU MUSTN'T MISS—

Begins on page 276



TOOTHLESS BLADE bites steel

Latest Word on Box-Strap Sawing

Have you heard about the use of ordinary box strapping to saw steel? If you haven't, you'll be interested to know it actually works. If you have, you'll want to hear the latest on the controversy it caused.

Solar Aircraft Co., San Diego, Calif., announced use of box strapping for production sawing several months ago. But many people interpreted the technique as having broader application than Solar experience would indicate. So FACTORY decided to clear up a few points for the record. Here are the questions we put to the Solar people—and their answers:

How are you using box strapping in production sawing?

Entirely on stainless steel and high-alloy steels in thicknesses up to ¼ inch.

Any other applications?

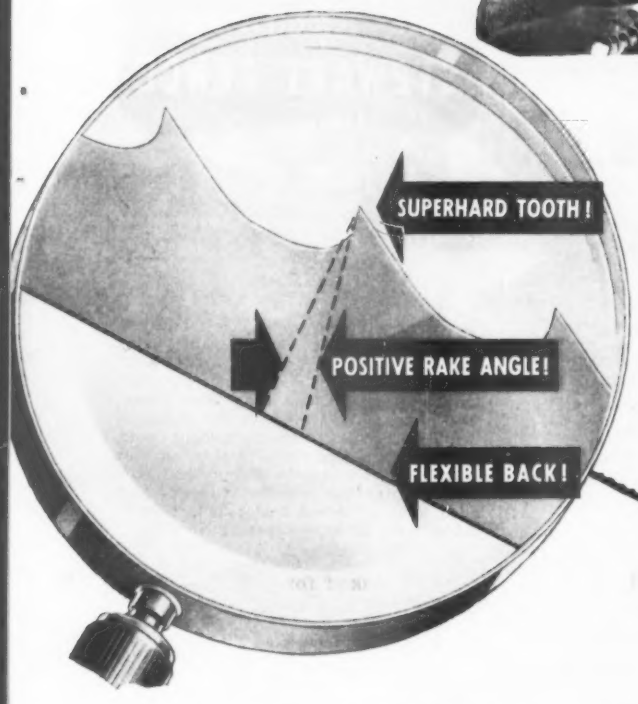
Solar research on the subject has been directed only at specific production problems within the company. It has done no research on the possibility of using different or thicker materials.

Turn the page

NEW!

DoALL CLAW TOOTH SAW BAND...

FOR METALS, WOODS, PLASTICS
EXTRA FAST CUTTING,
EXTRA LONG LIFE



Widths from ¼" to 1½". 2, 3, 4 and 6 pitch, depending on width.

NOW, for the first time, in the DoALL Claw Tooth saw band, mass production of a blade combining a *positive rake angle, hardened teeth* and a *flexible back* has been achieved.

Faster, free cutting with less feed pressure results from the hooked, claw-like teeth which actually "pull" into the material being sawed.

The superhard teeth give longer blade life with substantially higher cutting efficiency up to time of replacement than that of non-hardened blades which must be resharpened periodically.

The result is a blade that industry has been waiting for—a blade that reduces bandsawing costs and increases production when properly applied.

Eliminates Resharpening and Resetting—**it's cheaper to replace long-lived Claw Tooth blades than to use blades which must be resharpened a number of times during their life.**

Increases Production — **more output per machine and manhour because of faster cutting and elimination of blade removal for resharpening.**

Cuts Costs—**higher production and elimination of blade maintenance labor and equipment means lower bandsawing costs.**

Ask for Literature

Complete information, prices, specifications available upon request. Call your local DoALL Sales-Service Store or write:

THE DoALL COMPANY
254 N. Laurel Ave., Des Plaines, Ill.

In Canada: The DoALL Company of Canada, Ltd.
37 Clarkson Ave., Toronto 10, Ont.

DoALL

58-16

This Picture IS WORTH 1000 WORDS! Show Safety Saves! to Your Drivers

WHEN IT COMES TO TRAINING industrial truck operators, one picture is worth a thousand words. Clark's new "Safety Saves" movie is the only driver safety-training film in the materials handling field. It's a 30 minute sound movie, filmed entirely "on-the-job", and it's available to you on a loan basis.

1. "It's fun to watch the scenery; it's safer to watch the road."

2. "All right then . . . you won't make that mistake again!"

You (and your drivers) will see hair-raising examples of how *not* to handle a fork truck, as demonstrated by Willie the Cowboy. After you've seen Willie's way, you'll see the safe, correct way to drive and take care of a truck. To help cut accidents and improve driver performance, *all* your drivers should see "Safety Saves". Use the coupon to indicate when you want it—the only cost to you is return postage.

CLARK ELECTRIC AND GAS POWERED FORK TRUCKS

AND POWERED HAND TRUCKS • INDUSTRIAL TOWING TRACTORS

INDUSTRIAL TRUCK DIVISION
CLARK EQUIPMENT COMPANY • Battle Creek 12, Mich.

Send "Safety Saves": Date wanted_____
Alternate dates_____
Name_____
Firm Name_____
Street_____
City_____ Zone_____ State_____

YOU MUSTN'T MISS—

Begins on page 276

How big are the savings?

The cost per 1000 linear inches sawed of Inconel W 0.080 inch thick was about 60% of other sawing methods. The figure includes sawing labor, labor cost for installing blades, and cost of the blades. The cost was arrived at during production use of 7/16 x 0.035-in. box strap. Solar butt-welds the length in its own welding department.

Cost-conscious foremen who have witnessed a few trials of trained operators have asked for installation of box strap saws in their own departments.

Does box-strap sawing require special training?

A training program seems to be an essential for success in the techinque.

How does the box-strap sawing stand up in standard tests?

Not too well. But Solar has found that such factors as speed in cutting and pressure on the material cannot be standardized in practice. Every operator uses different speeds, different pressures.

The company does report the following test data—not standardized, but revealing:

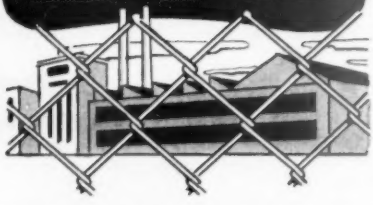
- Pressure. No operator-fatigue problems from use of the toothless saws.
- Burring. The operator can, by tilting the work, throw the burr to either side of the cut. So operators can be taught to throw the heavier burr onto the scrap.

Solar says its new method has actually decreased burring time over use of conventional saws.

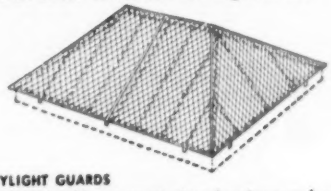
- Downtime from saw breakage. Box-strap breakage is only about 10% of former breakage with toothed commercial friction saws, says Solar.
- Heat. No trouble from excessive heat.
- Friction or binding in the slot. No difference on this So-

Turn the page

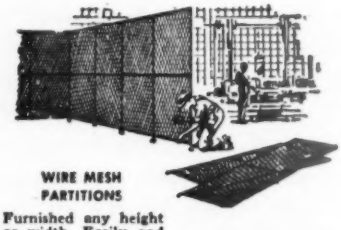
There's Security Behind a STEWART FENCE



The more difficult you make it for trespassers, the less chance there is of having trouble. Unfenced property invites vandalism. But when you surround your plant with a Stewart Chain Link Wire Fence, place guards at all windows and skylights, install steel gates at shipping room doors, you're practically invulnerable against trouble originating from the outside. Check all points of entrance NOW. If they are not adequately protected, better contact Stewart at once. Write for catalog No. 85.

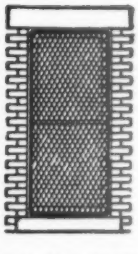


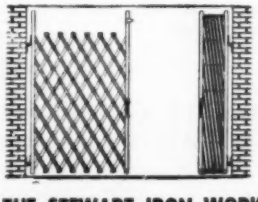
SKYLIGHT GUARDS
Strong, durable, prevent glass breakage and unwarranted intrusion. Prices on request.



WIRE MESH PARTITIONS
Furnished any height or width. Easily and quickly erected. When writing for prices, please give all measurements involved.

WINDOW GUARDS
(Wire or Iron)
Made with round or channel frames to fit any size or shape opening. When requesting prices, please give measurements and send diagrammatic sketch.





STEEL FOLDING GATES
Made in single or double gate construction to fit any width opening. Prices on request. Please give width and height of opening.

THE STEWART IRON WORKS CO., INC.
2056 Stewart Block Cincinnati 1, Ohio
Experts in Metal Fabrications Since 1886

Stewart IRON and WIRE FENCES

Hire these Speedy Production Triplets

better built by Black & Decker!

DRILL IT FASTER with a
Black & Decker ¼" HOLGUN*
Heavy-Duty, 25% more powerful—can't be stalled at rated capacity! Only 7¼" long, ¾" spindle effect; weighs only 5¼ lbs. Unmatched for close quarter drilling in wood, metal and plastics!
TAP IT FASTER with a new
Black & Decker ¼" TAPGUN*
Threads holes in steel, cast iron, brass, aluminum, 8 times faster than by hand. Only 10¼" long; weighs only 4½ lbs. Automatic reversing mechanism greatly reduces tap breakage!
DRIVE IT FASTER with a
Black & Decker No. 12
SCRUGUN*
Now 50% more powerful for increased capacity! Only 9" overall; weighs only 3¼ lbs. Positive and adjustable clutch. 90° Angle Head models.

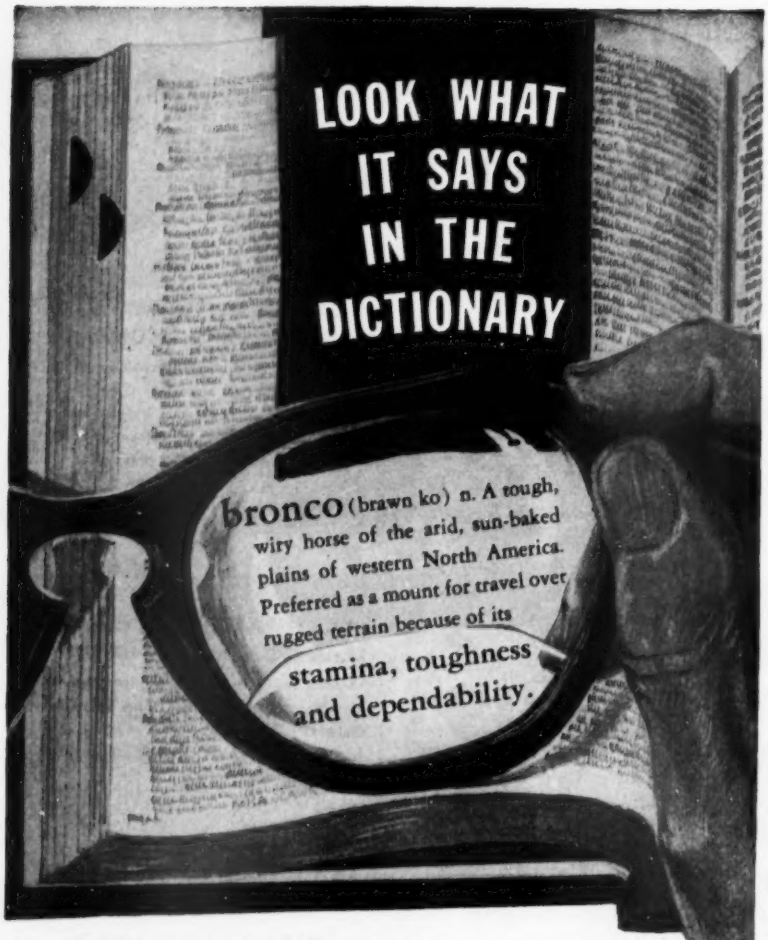
More output, fewer rejects, less fatigue!

THESE fast-stepping Black & Decker production triplets have a lot in common . . . and it's all good medicine for your production schedule! They're all powered by B&D-built universal motors, tailor-made for the specific tools they drive. They're all perfectly balanced and matched in design, with the famous "Pistol Grip and Trigger Switch" to give you easier handling, less worker fatigue. They're all engineered to turn out more uniform work at lower cost with fewer rejects. And they're all packed with the strength and stamina that Black & Decker builds into every part, every tool!

Find out how these production triplets can save you money, muscle and man-hours. See your nearby Black & Decker Distributor for a demonstration. Write for free catalog of over 100 Electric Tools to: THE BLACK & DECKER MFG. CO., 602 Pennsylvania Ave., Towson 4, Maryland.

*Trade Mark Reg. U. S. Pat. Off.

B&D


LOOK WHAT IT SAYS IN THE DICTIONARY
bronco (brawn ko) n. A tough, wiry horse of the arid, sun-baked plains of western North America. Preferred as a mount for travel over rugged terrain because of its
stamina, toughness and dependability.

that's why we call our portable cords and cables

BRONCO 60 *Certified*

It has a tough hide of 60% *by weight* Neoprene that is highly resistant to sunlight, ozone, oil, acids and alkalis. *Certified* has a heart of 99.9% pure soft annealed fine-stranded copper conductors coated with super-aging Cold Rubber insulation. Synchro-curing gives it stamina and flexibility. Jackets are branded with complete data; "BRONCO" repeated every two feet makes it easy to measure. To get the most dependable, flexible, convenient cord made, always specify Bronco 60 *Certified*.

WESTERN INSULATED WIRE CO.
Los Angeles 58, California

YOU MUSTN'T MISS—

Begins on page 276

lar has not found binding a difficulty.

Is Solar Aircraft telling all it knows about this technique?

No. It is studying the patentability of some of the techniques. If such patents are obtained, Solar will stell or license them to saw manufacturers. The company emphatically says it is not in—nor has it any intention of going into—the saw manufac.uring or marketing business.

Will Solar help out a company with specific sawing problems?

"We can't help most of the companies that have written us because our usage is so narrow. Since saw manufacturers are doing research all the time, we suggest that they are better equipped to answer specific sawing problems. We will try to help, but it is not our line and we probably cannot be of much assistance."

Pay-Policy Survey for Middle Management

For the first time, says American Management Assn., you'll be able to rate your company with other companies on how well it's paying middle-management executives. A survey of those pay policies is a new feature of AMA's executive compensation service.

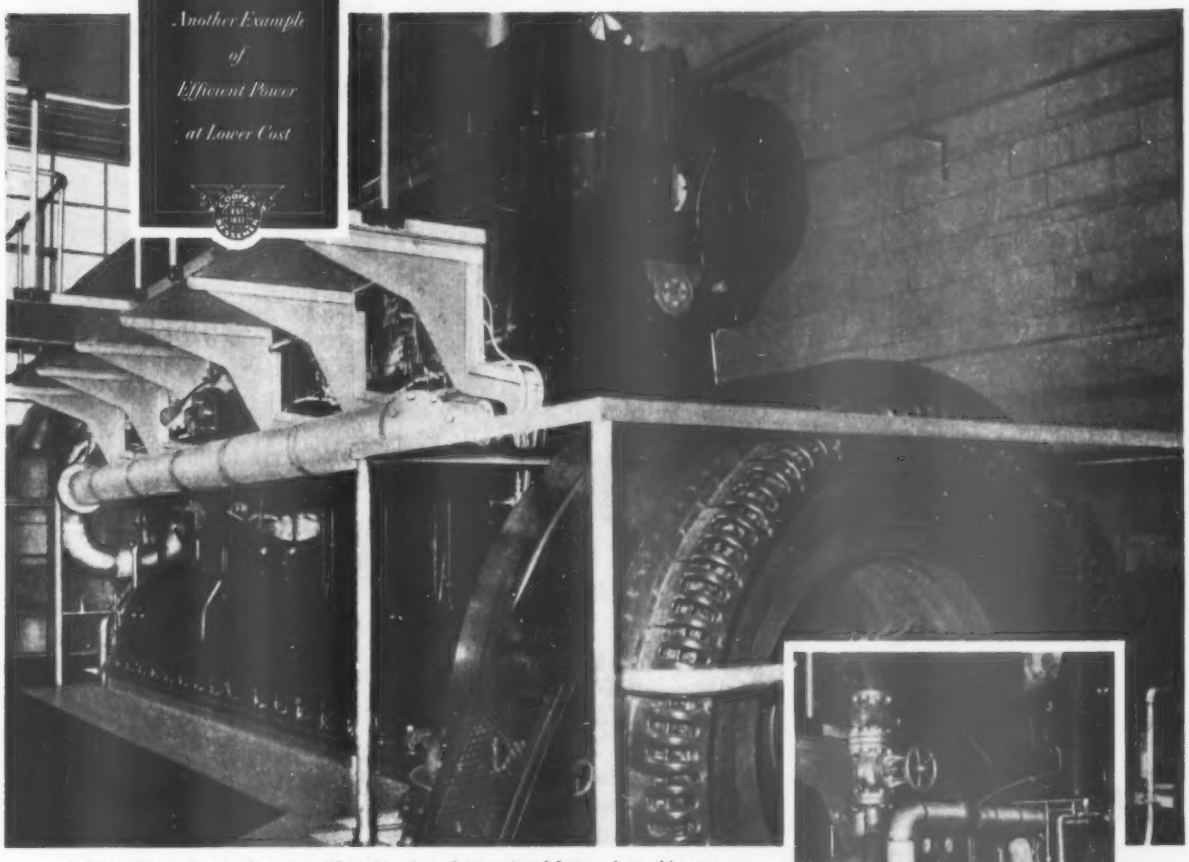
The first study will tabulate figures on more than 600 executives performing at least 35 functions in 25 companies. In later reports, AMA expects to include data from more companies covering more jobs.

The service will cost you anywhere from $125 to $300, if you're already a member of AMA. If you're not, you'll have to pay an additional $40 individual membership fee.

Interested? You can write the association at 330 W. 42nd St., New York 36.

Turn the page

Another Example of Efficient Power at Lower Cost



Latest of three Cooper-Bessemer LS-8 diesels in International Latex plant, this supercharged 1700 hp unit provides 40% thermal efficiency. End view at right shows piping setup for jacket water heat recovery contributing to 80% over-all thermal efficiency.

How they stretch dollars at International Latex

● Here's a diesel plant that is turning in amazing results—*80% over-all thermal efficiency!* The engine is a Cooper-Bessemer supercharged LS-8, installed in the International Latex plant at Playtex Park, Dover, Delaware.

To start with, this modern LS diesel exceeds 40% thermal efficiency — performance rarely equalled! On top of that, an ingenious jacket water heat recovery system captures for processing use another 40% of the total heat input.

In all there are three Cooper-Bessemer LS-8's in this International Latex plant—the supercharged unit shown above and two previously installed atmospheric LS-8's. Later on these original LS-8's can be easily converted to supercharged operation to boost their output and to match the remarkable efficiency of the new unit.

Whatever your power needs may be, check with Cooper-Bessemer. Find out how much you stand to save by the best to be had in efficiency and long, trouble-free engine life.

The **Cooper-Bessemer** *Corporation*

MOUNT VERNON, OHIO — GROVE CITY, PENNA.

New York Washington, D. C. Bradford, Pa. San Francisco Houston, Dallas, Greggton, Pampa and Odessa, Texas Seattle Tulsa Shreveport St. Louis Los Angeles Chicago Caracas, Venezuela Cooper-Bessemer of Canada, Ltd., Halifax, Nova Scotia Gloucester, Mass. New Orleans, La.

Indifference—whether it's under the "big top" or on the production line—is inexcusable and often fatal. You simply can't afford to take chances with a hard won reputation for quality performance. That's why we say it's a pretty good rule to stick to a solder you know and trust . . . time-proved Kester Solder, constant in solder alloy and always a consistent flux formula.

For the right Solder . . . the exact Solder you require . . . choose KESTER, the job-engineered Solder—8 Fluxes in Core Solder, available in 5 core openings. Also remember: Kester Solid Wire and Bar Solder, Kester "Solderforms" and separate Fluxes.

KESTER

SOLDER COMPANY

4213 WRIGHTWOOD AVENUE, CHICAGO 39, ILLINOIS
NEWARK 5, NEW JERSEY; BRANTFORD, CANADA

YOU MUSTN'T MISS—

Begins on page 276

QUOTES

A. A. Stambaugh of Standard Oil Co. (Ohio) **telling foremen how important they are:**

"The answer to the question 'What kind of a company is X company as a place to work?' will depend more on the foreman's leadership than any other single factor. The morale of an entire organization is usually determined far more by the first-line foreman than by such things as the President's Page or the house organ. That kind of leadership is worth a million dollars an ounce and is in demand at all levels of management."

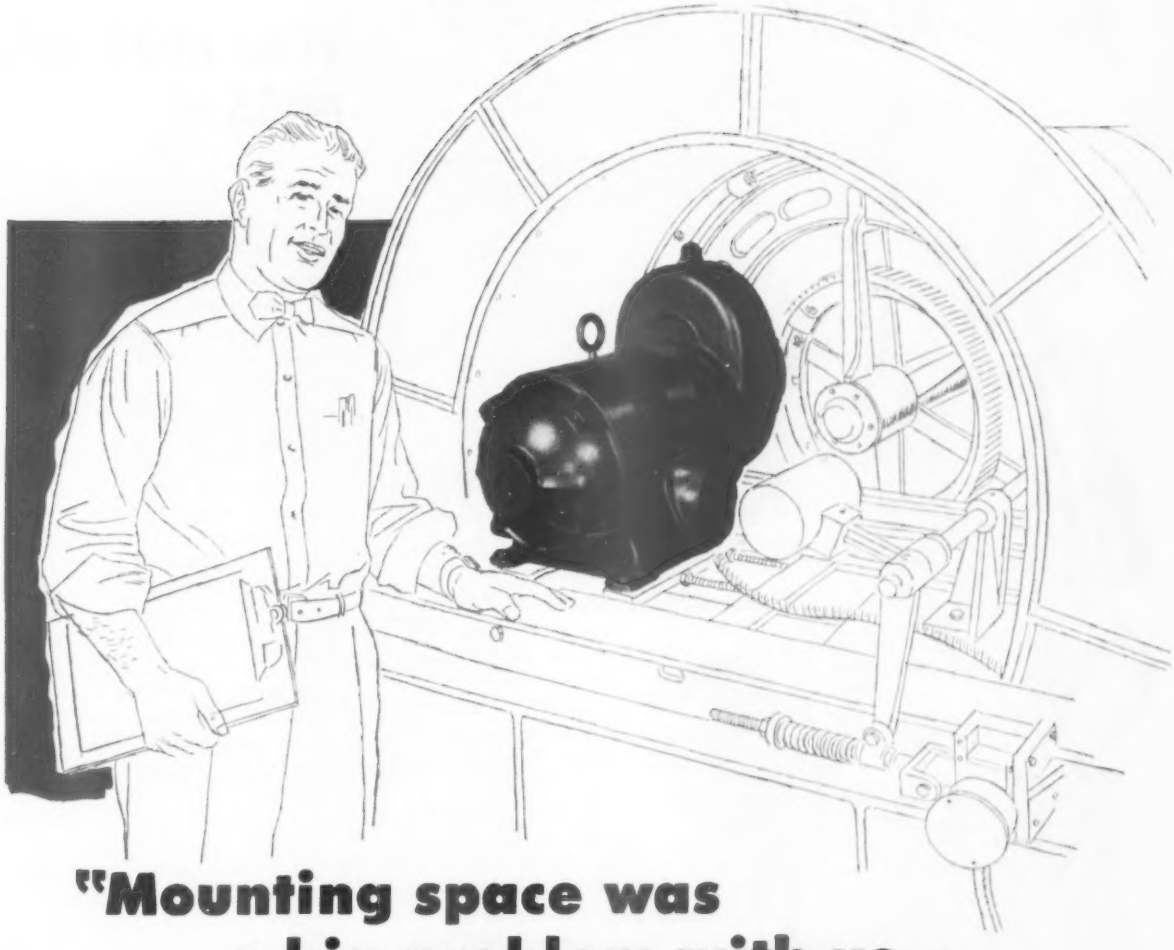
Henry F. Dever of Brown Instruments Div., Minneapolis-Honeywell Regulator Co., telling **why there's a big market for instrumentation in the obsolescent plant:**

"Thousands of older plants are daily approaching technological obsolescence, and in the future periods of intense competition, which we feel are not far off, will have to modernize or die."

Walter H. Wheeler, Jr., of Pitney-Bowes, **telling labor leaders what they ought not to do:**

"It is a simple matter to stand on a platform, distort a few statistics, point to apparent injustices, and convince the crowd that all they have to do is to fight oppressive management and gain the right to dip into a barrel of inexhaustible wealth."

Turn the page



"Mounting space was a big problem with us—

now we use *Life-Line* GEARMOTORS"

"There isn't much space left for mounting a geared drive by the time we squeeze in all the other components of this machine. We find that an integral-type gearmotor is a must and that a Life-Line Gearmotor, in particular, offers the best solution.

"These Life-Line Gearmotors take up less space than any other form of drive we have tried, such as: chains, belts, open gears or coupled speed reducers.

"Whenever we have a speed reduction drive problem we call in the local Westinghouse representative for consultation. I'm sure you'll find his assistance valuable also."

For complete descriptive literature on Life-Line Gearmotors, write to: Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-07314

YOU CAN BE SURE ... IF IT'S Westinghouse

Life-Line GEARMOTORS

NO INSTRUCTIONS NECESSARY WITH THIS EXTINGUISHER!

IT'S A RANDOLPH!

From bracket to blaze in split seconds! No valves to turn, no nozzles to adjust; just point and press your thumb and Randolph's cloud of snowy CO_2 kills fire completely!

Non-damaging Randolph CO_2 evaporates without a trace, is non-toxic, won't conduct electricity, deteriorate or freeze. And *all* Randolph Models are Underwriters' Approved.

A complete line of extinguishers and automatic systems

Learn how Randolph gives your plant panic-proof, positive fire protection! Write Randolph Laboratories, Inc., 4 E. Kinzie St., Chicago 11, Illinois.

RANDOLPH SIMPLIFIED FIRE EQUIPMENT

YOU MUSTN'T MISS—

Begins on page 276

James W. Irwin, public relations counsellor, **pointing out to industrial relations executives how they should explain management's side of a question in a labor dispute:**

"Think fast and act first in getting the company side to the public, press, and radio—and to your own employees—in any labor dispute, even to the extent of announcing a strike and scooping an international representative of a union. And when the dispute is settled, let the company announce the terms of settlement and resumption of operations instead of leaving such important information to the timing and interpretation of an outsider.

"Hold news conferences for newspaper and radio men if labor difficulties, indictments, or any other serious or adverse developments involve your company. See to it that your chief executive officers, or your resident executives at outlying operating points, make themselves available for questions and all-cards-out-on-the-table interviews."

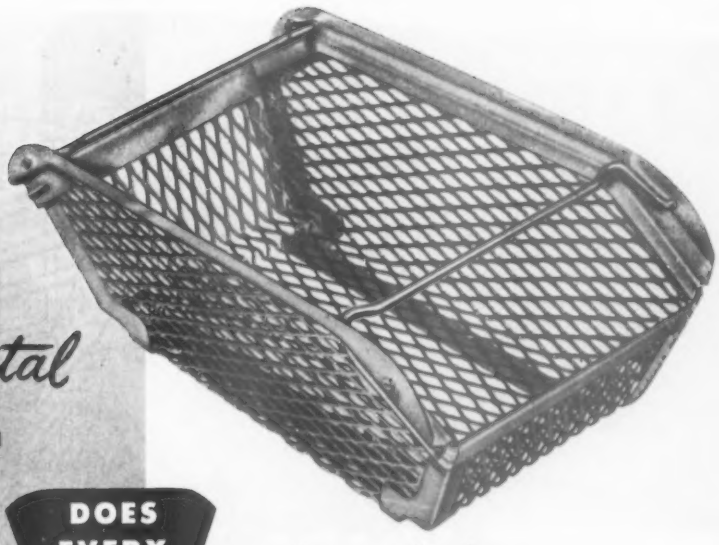
E. H. MacNeice of Johnson & Johnson explaining **what statistical techniques mean to industry:**

"They mean that more customers will receive what they want when they want it.

"They also mean that waste, scrap, returned goods, and production delays will be reduced.

"Finally they mean increased production without additions to facilities. This increase in production will be achieved with materials already bought and paid for, and without the expenditure of added human and physical energy."

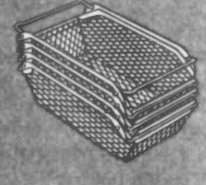
The NESTIER Expanded Metal BASKET



DOES EVERY SMALL PARTS HANDLING JOB!

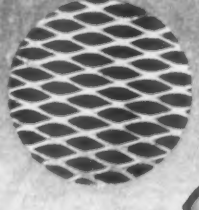
from stockroom through machining and dipping to assembly and inspection . . .

ALL THIS, IN ONE CONTAINER!



IT NESTS
IT TIERS

The basket is interchangeable with the standard sheet steel NesTier. Two standard sizes. Heavy-gauge steel, zinc plated.



Available in various sizes of mesh, baskets safely contain even tiniest parts—drain instantly after each immersion. Parts in baskets are quickly air-dried.

THERE'S NO RE-HANDLING OF SMALL PARTS when you use the NesTier Metal Basket!

This scientifically designed NesTier unit takes parts from the first machining operation, and moves them swiftly through *all phases of production*. By eliminating the need for changing containers when dipping or degreasing, NesTier Baskets effect *tremendous savings of time and labor*—actually *pay for themselves* many times over.

Constructed with all basic NesTier features, the basket serves perfectly as an all-purpose tote-box, usable from stockroom to loading dock. It can be transported by overhead and roller conveyors, on pallets and skids, or can be carried easily by hand. Requires minimum storage space, presents neat, orderly appearance wherever tiered or nested.

In every way, the NesTier Basket *streamlines* small parts handling, *cuts production costs.*

MATERIALS HANDLING ENGINEERS—WRITE FOR FREE DESCRIPTIVE BULLETIN TODAY!

Our service includes complete engineering advice to systematize small parts handling in your plant.

NESTIER®

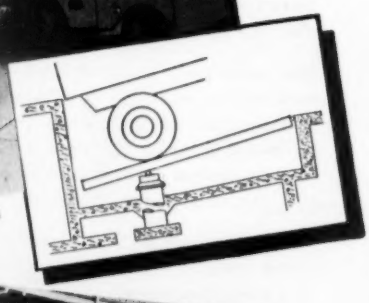
THE CHAS. WM. DOEPKE MANUFACTURING CO., INC.
Metal Specialties Division
ROSSMOYNE, OHIO

LOADING TIME CUT 75%

WASTEFUL HAULING ELIMINATED

WITH Wayne LIFTS

Wayne Loading Dock Truck Lift



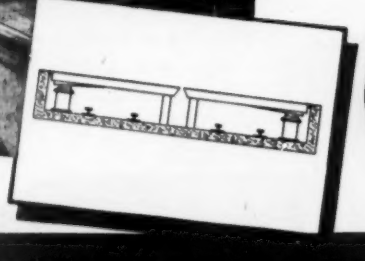
Wayne Loading Dock Ramps can slash 75% from truck loading time . . . Wayne Platform Lifts speed inventory stocking . . . Wayne Cross-Over Bridges eliminate roundabout hauling. From unloading of raw materials to loading of finished products, there's a Wayne Industrial Lift to speed your production, cut handling costs.

Wayne Lifts are custom-engineered to your plant's requirements . . . designed to save you time, labor and money . . . keep maintenance and down time at minimum. Other Wayne Lifts include truck lifts, sidewalk elevators, service lifts—all "precisioneered" for years of trouble-free operation and stepped up production. Write today for new Wayne Industrial Lift Booklet.

THE WAYNE PUMP COMPANY

SALISBURY, MARYLAND • TORONTO, CANADA

Wayne Bascule Cross-Over Bridge



Wayne

NATION WIDE SERVICE

WAYNE LIFT DIVISION, Ironton, Ohio

Westinghouse

TO BE SURE...

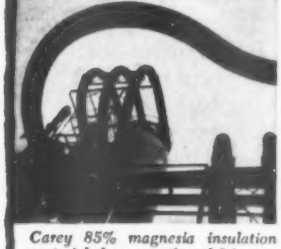
General Contractor--The Austin Company
Contractors-- Asbestos Erectors, Bound Brook, N. J.

put sidewalls of Careystone on their new TV-radio factory!

By choosing Careystone Corrugated, Westinghouse made sure of low maintenance costs and absolute fire safety for the lifetime of their new TV-radio plant at Metuchen, N. J. For Careystone never needs preservative treatment, will not rot, rust, corrode or burn . . . actually *gains* in strength with exposure to weather. Careystone resists termites and rodents, too. And its attractive, natural gray color saves painting expense.

Careystone is made of virtually indestructible asbestos and Portland cement, corrugated for great structural strength. It is quick, inexpensive and easy to erect. Comes in big 42" x 8' sheets that cover fast. Can be applied over steel or wood framing; sawed to fit irregular areas.

Careystone is suitable for exterior or interior walls, partitions, storage buildings, to highlight a few uses. If you plan a new plant, or addition, give serious thought to the advantages only Careystone can deliver. Ask your Carey Industrial Sales Engineer for the latest Careystone Corrugated Manual No. 52–84 fact-filled, money saving pages. Or, write on your letterhead for a copy today.



Carey 85% magnesia insulation materials have weathered 24 years of continuous service on the fractionating tower and vapor lines of these atmospheric and vacuum stills at Gulf Oil Corporation's Port Arthur, Texas plant.

Built-up roofing at the White Motor Co. truck plant in Cleveland, Ohio. Kept in prime condition by tough, lasting Careyclad and Carey Fiber Coating–formulated to withstand the grinding abrasion of weather, corrosive fumes, and time!

Over 100,000,000 crossings without one cent for repair or replacement! That's the toughness and durability record of Carey Asphalt Plank surfacing on the Harlem River span of famous Triborough Bridge in New York City!

Get Your Copy of This Valuable Manual.

84 fact-crammed pages listing uses for Careystone, erection details, estimating procedures. Hundreds of "how to" diagrams. Write on your letterhead for your FREE copy right away.

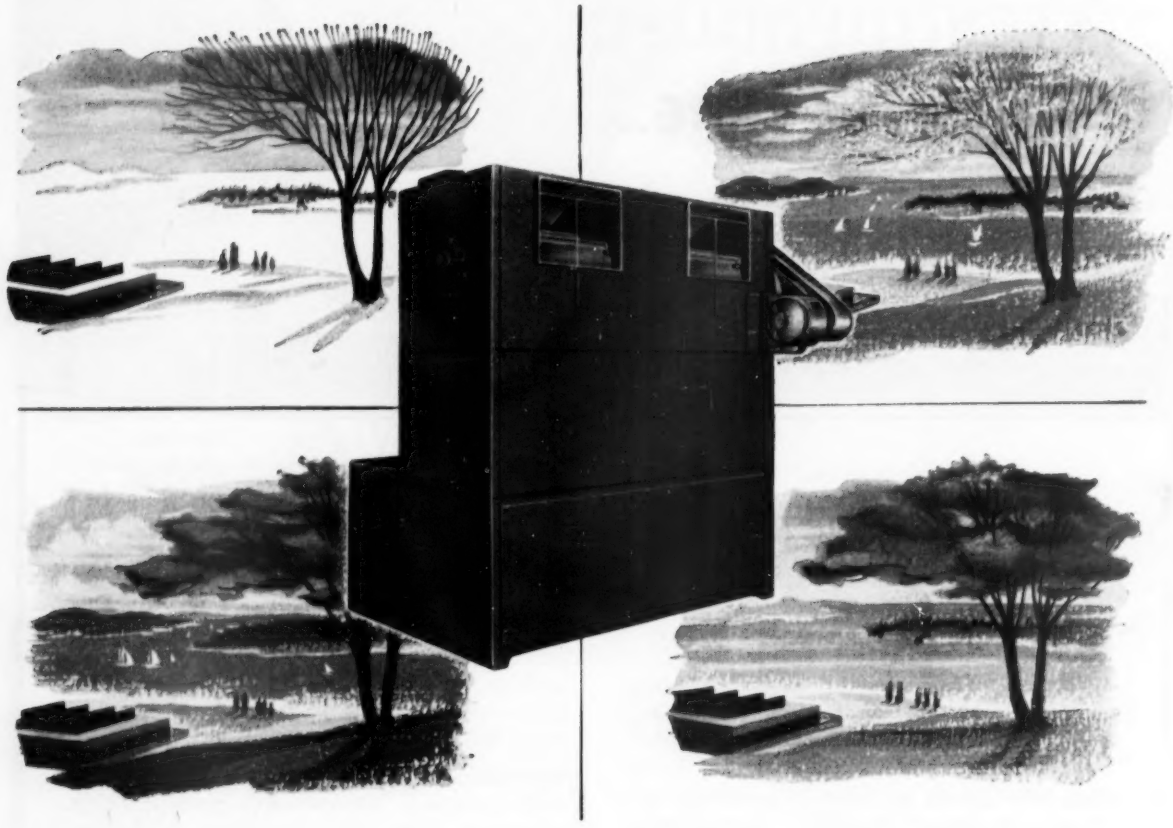
FROM THE HOUSE OF CAREY—

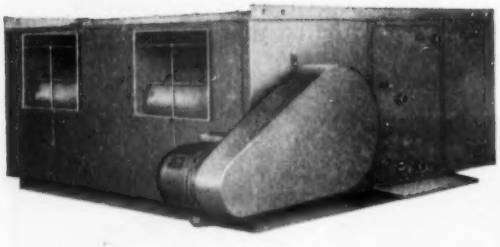
Careystone Corrugated and Flat Sheets • Built-up Roofing • Bonded Roofs • Super Light 85% Magnesia Insulation • Asphalt Plank • Asphalt Paints and Coatings • Other Famous Products for Industry Since 1873

Carey.

THE PHILIP CAREY MFG. COMPANY, LOCKLAND, CINCINNATI 15, OHIO. IN CANADA: THE PHILIP CAREY CO., LTD., MONTREAL 3, P. Q.

American Blower Air Conditioning Units





American Blower Type A Conditioner. Capacities from 1000 to 13600 cfm. Either direct expanded refrigerants, chilled water, well water or brine can be used for cooling and steam or hot water for heating.

American Blower Air Conditioning units are designed for summer cooling and dehumidifying and winter heating and humidifying.

This dual function by the same piece of equipment results in substantial savings in cost and offers much in comfort.

Three types are available: the Type A Conditioner for normal unitary type applications, the Type S Conditioner for unitary type application where washed air or high relative humidities are required, the Type M Conditioner for central system installation.

For data, consult the nearest American Blower Branch Office.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN • CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

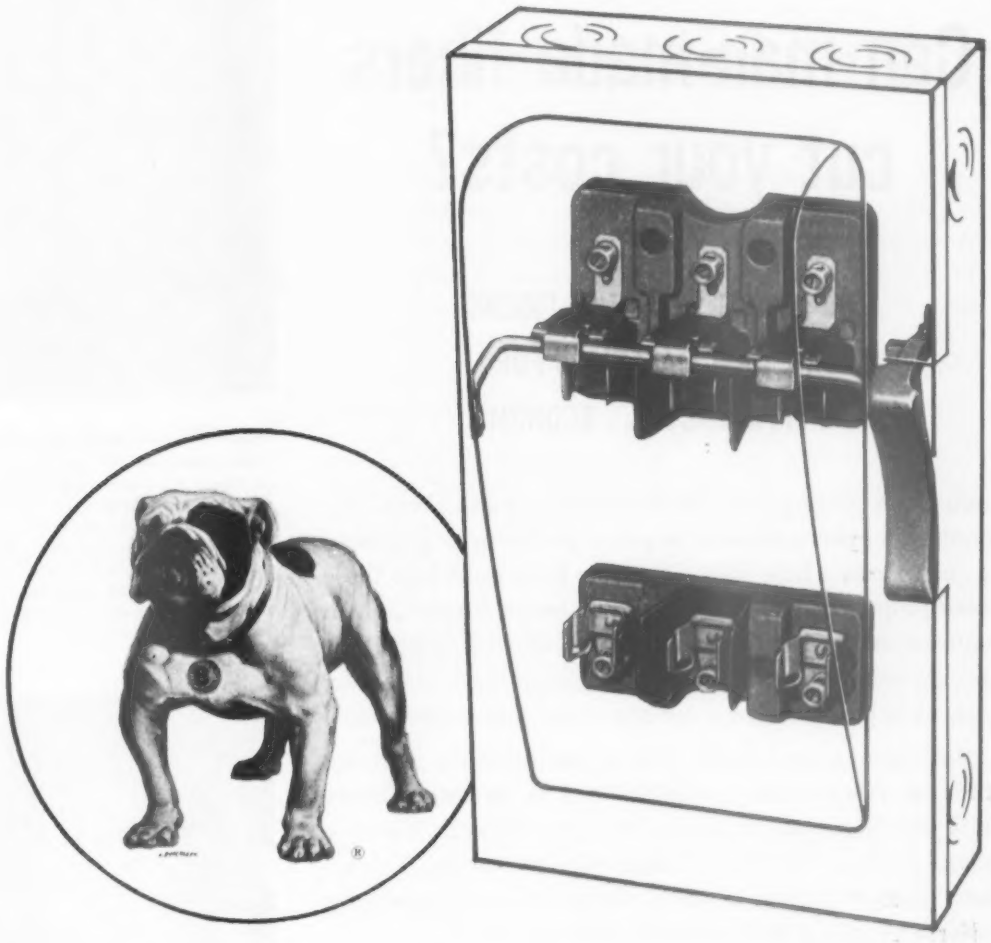
Division of American Radiator & Standard Sanitary corporation

AMERICAN BLOWER

YOUR BEST BUY IN AIR HANDLING EQUIPMENT

Serving home and industry: AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS

BULLDOG VACU-BREAK SAFETY SWITCH



It's a Thoroughbred--and Looks it!

A THOROUGHBRED — whether a dog or a safety switch — always looks the part because it's better on all points. In the BullDog Vacu-Break Switch — the thoroughbred of safety switches — the trim, functional exterior is the direct result of fine engineering and design of interior components.

LOOK INSIDE . . . and see how BullDog's exclusive Vacu-Break with its practical, compact design, gives you both extra safety and clean-lined tailoring. See how all parts and assemblies are engineered as a perfectly co-ordinated unit to assure maximum efficiency, safety and economy.

WRITE TODAY FOR FREE Bulletin B-250, and get complete details on BullDog Vacu-Break Safety Switches. BullDog Electric Products Company, Dept. FM33, Detroit 32, Michigan.

BULLDOG
ELECTRIC PRODUCTS COMPANY

© BEPCO

Can man-made fibers cut your costs?

DU PONT'S VERSATILE FIBERS ARE RAW MATERIALS FOR NEW EFFICIENCY . . . ECONOMY

Industry is finding that Du Pont's man-made fibers offer countless opportunities to improve products or processes . . . or to create new ones. Chemists have built into these fibers properties that nature can't always supply . . . in combinations that meet the complex needs of industry. The uses shown here may suggest unexpected ways of solving your own problems . . . cutting your production costs.

But these examples give only a glimpse of the amazing range of possibilities available to you in these fibers. Du Pont offers you a choice of these versatile fibers—nylon, acetate, "Cordura" high tenacity rayon, "Orlon" and "Dacron"—each of them chemically and physically uniform as only a fiber made by man can be.

See your own supplier for industrial products made with these fibers. They may better serve your needs, too. For information about any or all Du Pont fibers, write E. I. du Pont de Nemours & Co. (Inc.), Textile Fibers Department, Wilmington 98, Delaware.

NYLON: ***Its fast-drying properties doubled production.*** The speed of a fabric-printing machine was retarded by the time taken to clean and dry the griege—a cloth used to blot up excess dye. Easy-cleaning, fast-drying nylon grieges have now virtually doubled machine speed and production. Costs were cut, too, because nylon's exceptional strength when wet makes these greiges outlast others 5 to 1.

"ORLON": ***Its acid and heat resistance turned a processing loss into a profit.*** A carbon-black manufacturer found a desirable new process unprofitable because fine particles were lost through the stack. Ordinary filter bags were useless because acid fumes quickly destroyed them. But bags of acid-resistant "Orlon" stood the test . . . made the new operation profitable.

DU PONT
REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING
...THROUGH CHEMISTRY

NYLON
ACETATE
CORDURA*
high tenacity rayon
ORLON*
acrylic fiber
DACRON*
polyester fiber
*Du Pont trademark

fibers to fit industry's

"CORDURA": *Its stretch-free strength multiplied life of belting.* Severe heat and dust in drying ovens were breaking down transmission belts, in as little as 44 days, causing expensive shutdowns. Engineers suggested belts sinewed with "Cordura" for greater strength, less stretch and slippage. After 2¼ years of continuous service, these belts are still going strong.

"DACRON": *Its high tenacity and stretch-resistance improve fire hose.* By using "Dacron" for the load-carrying "filling" cord, fire hose can be made more flexible, 12 to 15% lighter, and 50% stronger than conventional hose of the same diameter. One fire department reports that its trucks can now carry 1500 ft. of hose, as against 900 ft. formerly.

needs

A reader tells about

...Cooperative Education in Britain

Stimulated by our article on Cooperative Engineering Education (FACTORY, November 1952, p. 104), an Ameican engineer describes English technical colleges, from first-hand experience. The one-day-a-week cooperative system has been working there for more than 20 years.

DEAR EDITOR:

The article on Cooperative Engineering Education in your November issue was especially interesting to me.

I had heard of this type of course at the University of Cincinnati some years back, but until I read your article I didn't realize just how it operated or how widespread was its application.

I am a former student of engineering at Oklahoma University. Before starting my work in the engineering department of Riley's (Riley Stoker Corp., Worcester, Mass.), I worked in England for 3½ years, most of the time as an engineer.

While there I studied the British educational system in detail, and actually attended one of their technical colleges. The type of college I attended has never been given publicity in this country, to my knowledge. Yet colleges of this kind furnish by far the majority of engineers for British industry.

These colleges confer on grads what is known as the "Higher National Certificate." There is a marked similarity between the Higher National Certificate course and the co-op plan publicized by FACTORY.

For 5 years the HNC student spends four days a week with his company, one day in school. He is paid for the full week at an apprenticeship rate. The first 2 to 3 years are the workshop training period for the student. The remainder of the period is spent on the drawing board for the company.

Britain initiated this program some 20 to 30 years ago for the very reason your magazine suggests it might be useful over here —shortage of engineers. However, there is a marked difference in that the British were forced into this program during a comparatively peaceful period. The regular 3- to 4-year colleges required a financial outlay far too great for the average student.

Actually the HNC course does not cover the U.S. theoretical requirements for a B.S. This is easy to understand when one considers that students attend school only one day a week. But these schools do cover all the basic engineering principles covered in the 4-year course here, including machine design, theory of structures, differential equations, etc. And their standards are high.

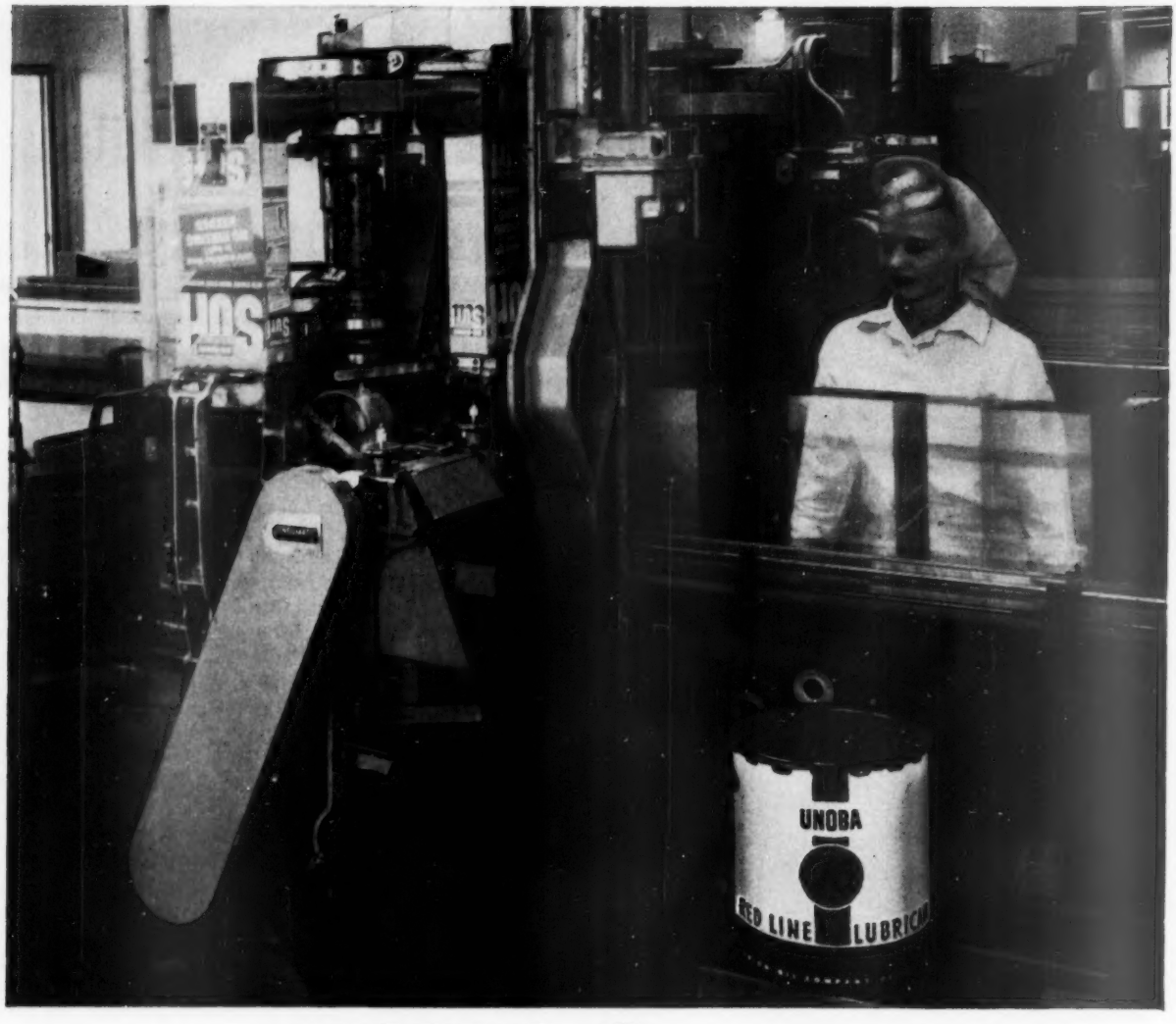
It is recognized in Britain that the HNC course is lacking from the liberal arts point of view, and attempts are being made to correct this. However, these colleges, even as set up at present, have provided England with a good educational medium. Their graduates are far ahead of the U. S. grad (in my opinion) from the standpoint of production techniques (workshop methods).

I believe U.S. industry could well accept more fully the co-op system of training its engineers.

Respectfully,

R. L. MATEER

WORCESTER, MASS.



UNOBA Grease Guards Against Costly Shutdowns

Things must keep moving fast in this soapmaking plant. That's why this folding and gluing machine is lubricated with dependable, multi-purpose UNOBA grease.

Because of its versatility, UNOBA can be used in practically *all* your grease-cup and gun fittings. In some factories, this one grease has replaced as many as seven specialized lubricants. UNOBA will protect against rust, prevent excessive wear and prolong the life of machinery parts.

Multi-purpose UNOBA is a *barium*-base grease. This makes UNOBA ideal for many unusual operating conditions because it is able to resist *both* heat and water. UNOBA sticks to metal surfaces at temperatures ranging from below freezing to over 300 degrees F., *regardless of moisture!*

OFFICES: LOS ANGELES: Union Oil Building • NEW YORK: 4904 RCA Building • CHICAGO: 1612 Bankers Building
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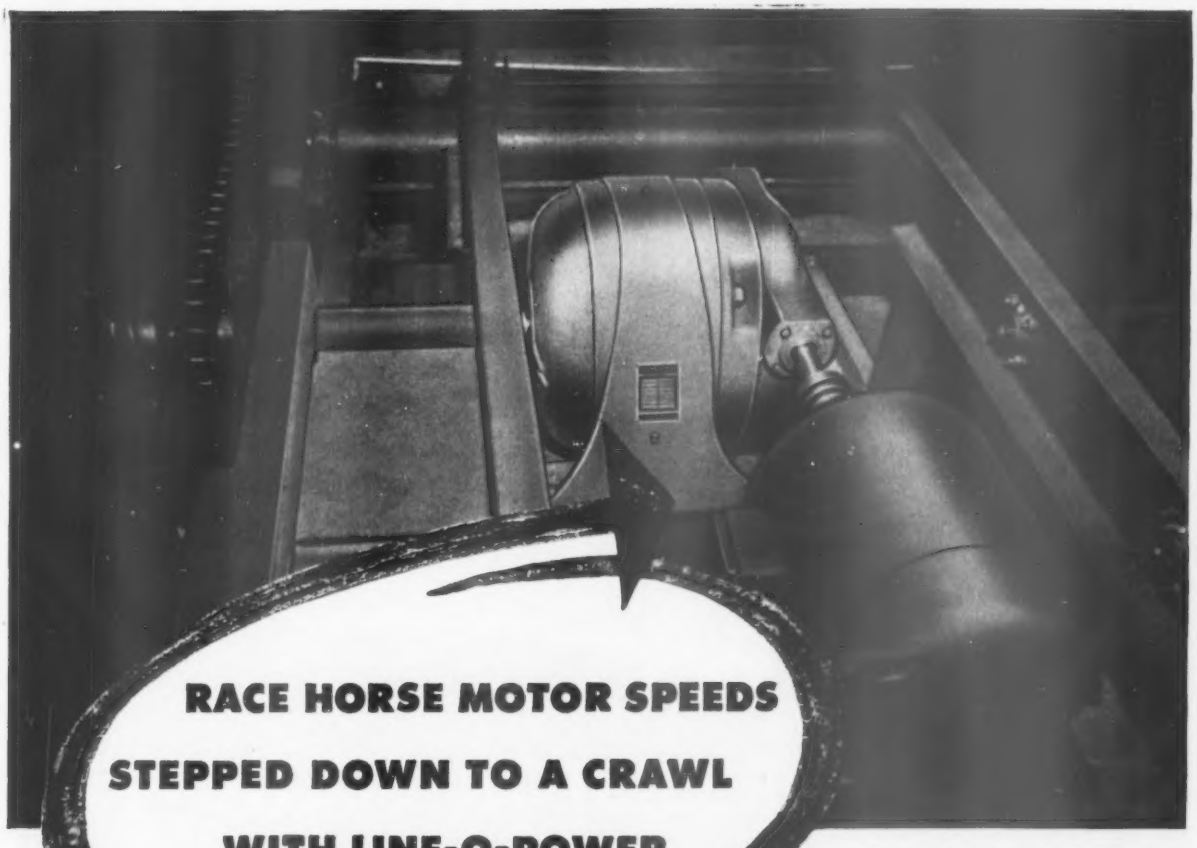
UNION OIL 76 COMPANY OF CALIFORNIA

Developed by the manufacturers of T5X—the amazing purple heavy-duty motor oil.



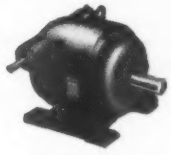
RACE HORSE MOTOR SPEEDS STEPPED DOWN TO A CRAWL WITH LINE-O-POWER

24WL Right angle Line-O-Power Drive on a Chain Conveyor

Double reduction straight line drive

Triple reduction straight line drive

Double reduction vertical drive



Double reduction right angle drive

FOOTE BROS.

Better Power Transmission Through Better Gears

FOOTE BROS. GEAR AND MACHINE CORPORATION
4545 South Western Boulevard • Chicago 9, Illinois

On conveyors or other materials-handling equipment, slow speed is essential. With Line-O-Power Drives, it is possible to transform high motor speeds into almost any desired slow end speed.

Here, for example, is a compact Line-O-Power Drive on a chain conveyor. Low in original cost, it provides economical service day in and day out with minimum attention. These drives have proved their value to industry because of their compact size, sturdy construction and high efficiency.

First reduction is taken through precision worm gearing, second and third reductions through Duti-Rated helical gearing. Duti-Rated Gears have file-hard tooth surfaces with ductile cores that permit heavy loading and yet assure long life. Available for straight line service — for right angle service — or for vertical application.

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Please send me Bulletin LPB on Line-O-Power Drive.
I am interested in
☐ Straight line drive ☐ Vertical drive ☐ Right angle drive

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Company.....
Position.....
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WELDED RESISTOR SECTIONS

up to 150 amperes continuous capacity without internal paralleling

No Crowding . . . 3/8" to 3/4" spacing between grids in EC&M Types TW and TW-X Sections

In both styles of EC&M Welded Plate Resistor Sections, heat radiation is *efficient*. Spacing between grids is a minimum of 3/8" on the smallest grid size up to a 3/4" maximum on the 150-ampere continuous capacity section.

Likewise efficiently designed are the individual grids, resulting in completely covering a plant's requirements with a *minimum* of sizes.

Remember, also, these EC&M TAB-WELD Resistors may be used "off-the-storeroom shelf." Many taps make on-the-job connections easy and readily permit small adjustments in resistance-value.

SPECIFY EC&M BULLETIN 942
EC&M TAB-WELD RESISTORS

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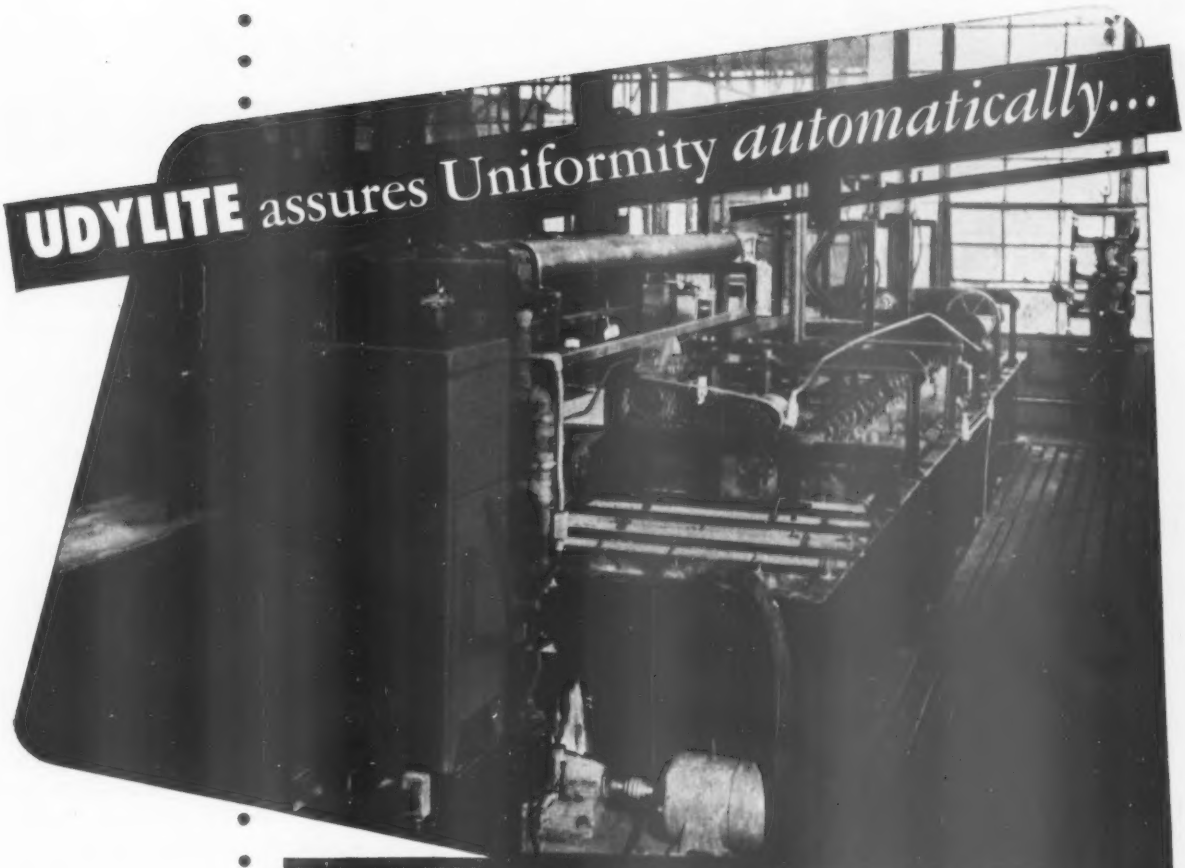
THE ELECTRIC CONTROLLER & MFG. CO.
2698 EAST 79TH STREET • CLEVELAND 4, OHIO

UDYLITE assures Uniformity *automatically*...



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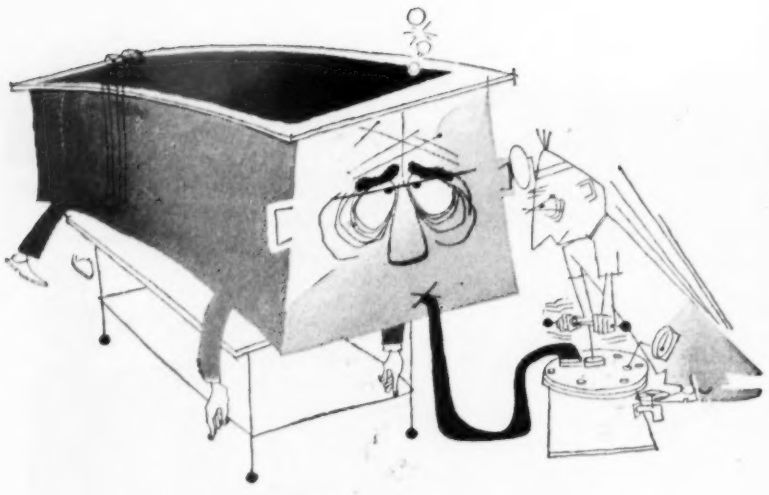


has **coil-itis*** cramped
your production flow?

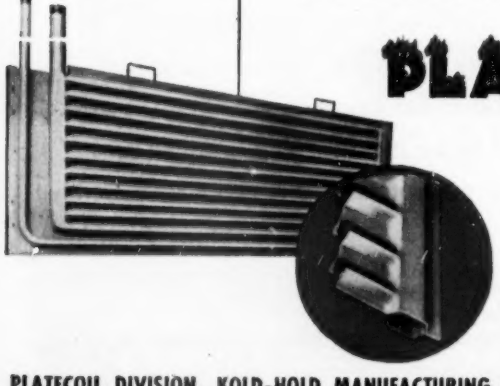
It's a waste of costly time to pump out the solution every time your process heating and cooling tanks get indigestion due to pipe coil troubles. You can save this cost and eliminate production bottlenecks by replacing the pipe coils with Platecoils. Platecoils can be removed and replaced **without dumping the solution.** They simplify maintenance and save hours of downtime. They heat or cool 50% faster and take 50% less space in the tank. As revolutionary as the new wonder drugs, Platecoils cure production troubles involving heat transfer . . . and give profits a shot in the arm.

Write for bulletin P60 today!

PLATECOILS SAVE 50% IN HEAT TRANSFER COSTS

PLATECOILS TRIPLE PRODUCTION

At Continental Motors Corp., 3 crankcase sections can be cleaned at one time when Platecoils are used while only one crank case can be cleaned with pipecoils in the tank. Ask about other case histories.



PLATECOIL

REPLACES PIPE COILS

*

Coil-itis — Diagnosed as tank heating and cooling problems. Platecoils — the prescription for solving pipe coil problems.

PLATECOIL DIVISION, KOLD-HOLD MANUFACTURING CO., LANSING 4, MICHIGAN

NEW MATERIALS

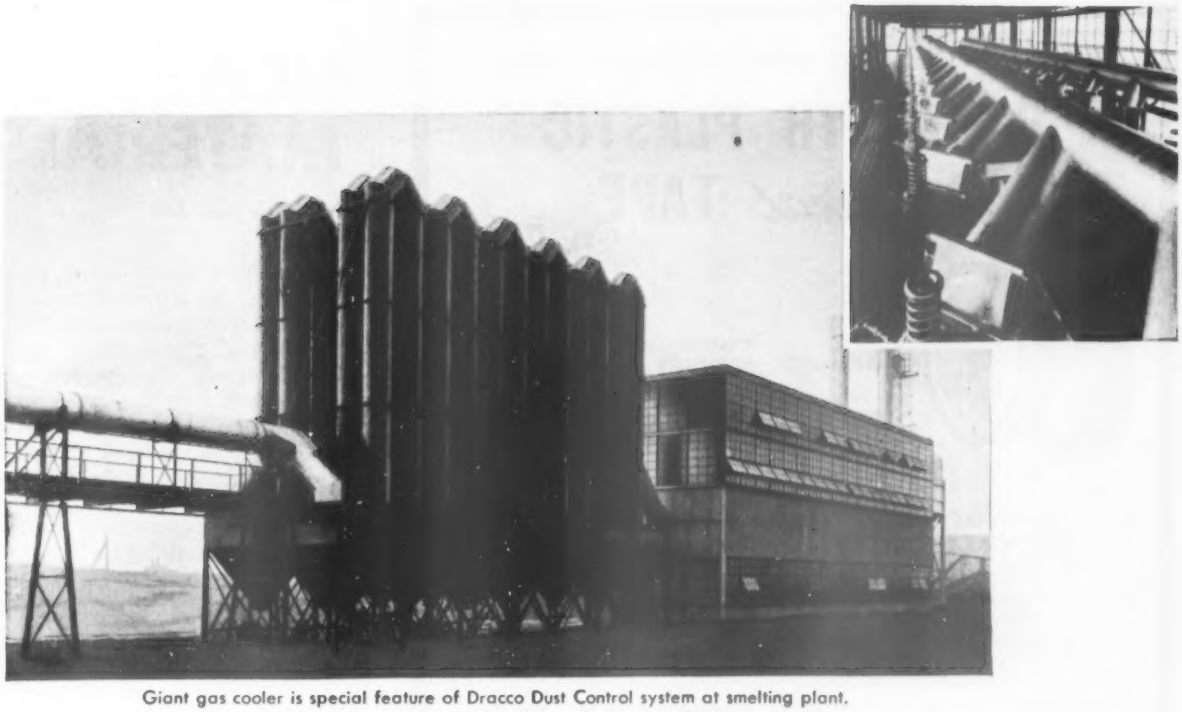
A NEW LIGHTWEIGHT INDUSTRIAL FABRIC which is said to be strong, nonabsorbent, mildew-proof, and fungi-proof has been marketed by Thermoplastic Fabrics, 1457 Broadway, New York City. Added features of Fortron are that it is acid, grease, and flame resistant and will not shrink or crack at temperatures as low as −30F. Constructed of two sheets of Vinyl film and a center layer of glass fiber fabric, it is possible to make sheets of any size. Fabric weighs as little as ½ oz. per square yard and its strength comes primarily from the center layer of glass fiber.

ALUMINIZED COATING that dries in a matter of minutes and strips off easily without the use of a solvent is now in production at the Eagle Chemical Co., Industry Ave., Joliet, Ill. Applied by either brush, dip, or spray, Spray Strip prevents damage to products from moisture, salt air, salt water, grease, oils, and abrasion during shipping or storage. Available in various sizes—1-gal. cans to 50-gal. drums.

ELECTRICAL INSULATING RESIN designed for coating glass cloth and sleeving and for bonding mica-glass combinations is now available at the Dow Corning Corp., Midland, Mich. This new silicone varnish has more than three times the dielectric life of the silicone varnishes now in commercial use, the manufacturer claims.

REINFORCING MAT designed specifically to strengthen plastics of any color is being manufactured by the Ferro Corp, 200 Woodycrest Ave, Nashville, Tenn. Called Uniformat, it is made of fiber glass chopped strand matting which is almost pure white and uniform in weight and pattern.

Turn the page



Giant gas cooler is special feature of Dracco Dust Control system at smelting plant. 36 Dustomatic Filters (inset) are housed in building (right).

IS YOUR DUST PROBLEM ANY TOUGHER THAN THIS?

Dust recovery in the smelting business is difficult. Complicating factors such as high temperatures and severe conditions demand specialized engineering and equipment.

Consider the problem Dracco undertook at a large secondary smelter in Chicago, Illinois. Secondary smelting operations produce gaseous fumes at 2200° F. containing a valuable product, zinc oxide. Without efficient product recovery, the sub-micron size particles are lost in exhaust to the atmosphere. Dracco's job: recover the zinc oxide economically and efficiently.

Application engineering by Dracco furnished the answer. First, the gas temperature is reduced to normal filtering temperature by specially designed water coolers, stainless steel lines and a giant U-tube cooler. Then, the 36-unit Dustomatic Filter system collects all zinc oxide automatically and continuously. This Dracco installation has proved highly efficient and profitable.

Dracco Engineers with a broad background of experience in solving industrial dust problems are constantly at your service. If you have a tough problem in the control or recovery of dust, call in Dracco.

DRACCO CORPORATION
4075 East 116th Street, Cleveland 5, Ohio

"Industrial Dust Control and Recovery" is the title of a new Dracco bulletin. Write for your copy today.

DRACCO *Performance Proved*

Airstream CONVEYORS · DUST CONTROL EQUIPMENT

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Electrical TAPE

PACKED INDIVIDUALLY
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CONVENIENT FIVE-PACK
Five 30-ft. rolls, ¾" width in handy container

RECOMMENDED IN PLACE OF FRICTION AND RUBBER TAPES IN THE FOLLOWING SITUATIONS:

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2. Where space is limited (makes neater job, as in terminal box).
3. Where tape is subject to water, acids, alkalies, corrosion (resists all).
4. Where time must be saved (does the job much more quickly).

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Manufacturers of SLIPKNOT — The World's Largest Selling Friction Tape
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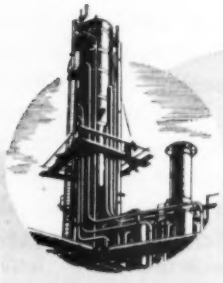


REFINERY TOWERS

INSULATED PIPELINES

NEW MATERIALS

Begins on page 310

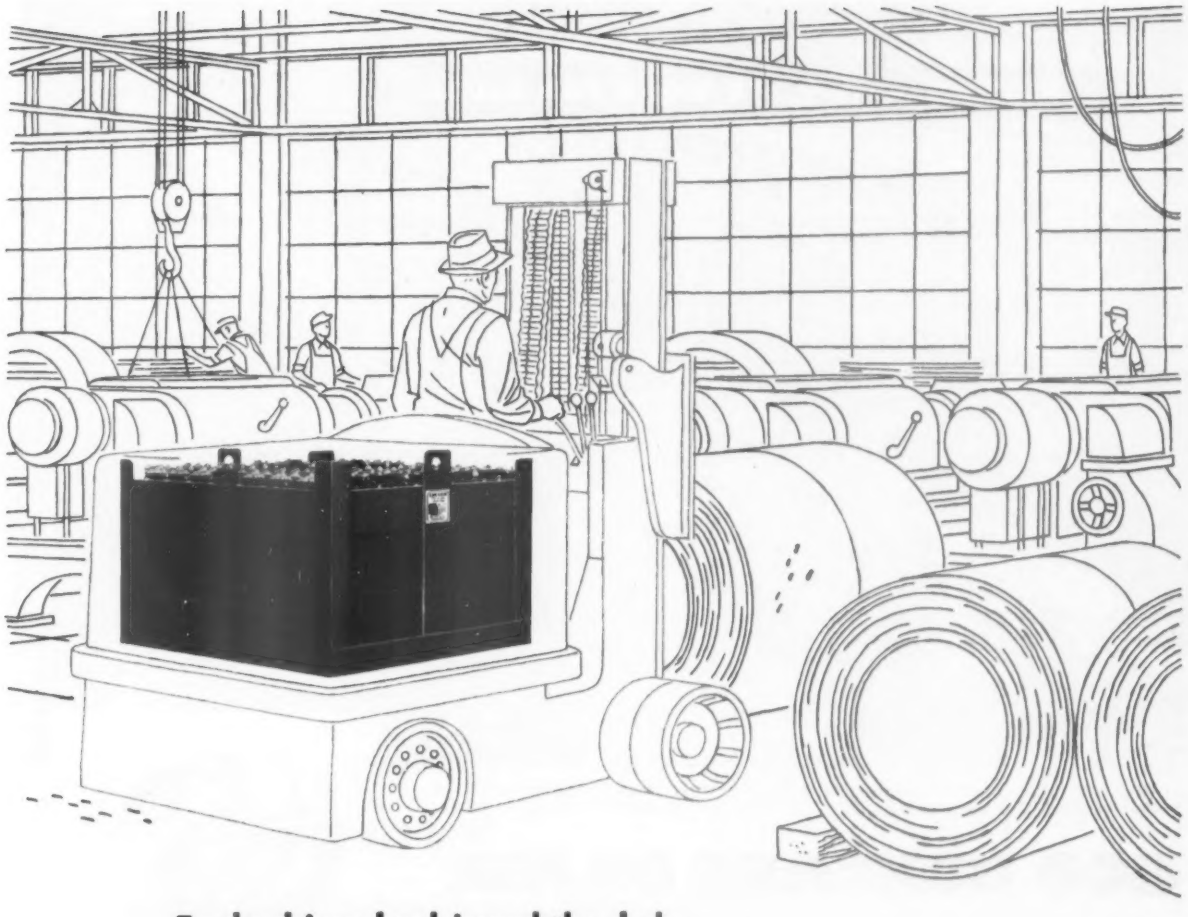
HARD-FACING ALLOY with good resistance to abrasion at high temperatures is offered by Coast Metals, Inc., Little Ferry, N. J CM-199 is easy to weld and can be applied with any good arc welding process. It will weld over itself and most ferrous materials without checking, cracking, or porosity.

RESIN-SURFACE COATING, designated as Type X-5, which adheres to various alloys of copper, aluminum, and magnesium is in production at Furane Plastics, Inc., 719 W. Broadway, Glendale, Calif. Applied from solution, the coating is then baked per manufacturer's instructions to form an acid- and alkali-resistant film.

SANDED FORM BOARD is the newest insulating product of the Owens-Corning Fiberglas Corp., Toledo, Ohio Designed for low exposed ceilings where maximum attractiveness is desired, the sanded board offers additional advantages in light weight, fire safety, noise absorption, and low heat transmission.

LUSTREX 886 is a new resin which eliminates clay balls from foundry sand, thus improving the workability, flowability, and packability of sand. Developed by the Monsanto Chemical Co 's Plastics Division, Springfield, Mass. One pound of Lustrex 886 produces uniform clay distribution in one ton of foundry sand.

MOLYKOTE-SILICONE, Type 77, a new lubricant adaptable for use on synthetic rubber, plastics, leather, and nylon and fiber bearings has been announced by The Alpha Corp., Greenwich, Conn. It combines the features of silicone lubricants with the bearing pressure lubricity of Molykote.



Trucks driven hard, 'round-the-clock

need the plus-values in EDISON batteries . . .

EASILY EXCHANGED—QUICKLY RECHARGED—DOUBLY DEPENDABLE

When duty cycles for industrial trucks are longest and toughest, the *extra* advantages of EDISON batteries often become the *most essential*. Then, more than ever, EDISON batteries deliver the greatest value at any price.

In rugged 24-hour truck service, they can be exchanged in two minutes, fully recharged in 6 to 7 hours. They have no finish-rate limitations, require no equalizing. They are easily ventilated, too, if they must work in high temperatures.

In fact, EDISON batteries are so foolproof electrically that even such accidents as external shorts and reverse charging cannot injure them. Consider, also, their famous steel cell construction, another major reason for their unequalled stamina throughout a useful life two to three times that of other batteries.

EDISON *plus-values* are more fully covered in our bulletins S.B. 3808 and S.B. 2039. Write for them and the address of your Edison field engineer. Edison Storage Battery Division of Thomas A. Edison, Incorporated, West Orange, N. J.

Most Dependable Power—
Lowest Over-All Cost
. . . you get both with an EDISON

EDISON

Nickel · Iron · Alkaline

STORAGE BATTERIES

These huge natural gas engines, about 40 to a room, drive the generators, furnishing all the electricity used by Alcoa to produce 170,000,000 pounds of aluminum in this plant yearly.

800 BOXCARS OF AIR

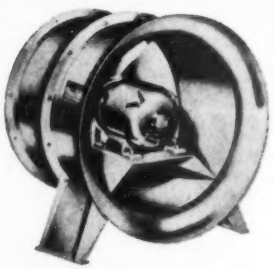
KEEP GENERATORS AT PEAK EFFICIENCY

Down at Point Comfort, Texas, a new kind of power plant was built a few years ago. 120 engines, running on natural gas, drive huge electric generators. Their job: to supply the current to smelt defense-needed aluminum. One of the biggest problems, though, was to keep the equipment running cool and thus at top efficiency.

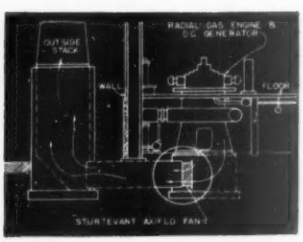
120 Westinghouse Axiflo® fans did the trick. Each draws 12,000 cubic feet of air through the generators every minute, picking up the excess heat. Then the air is piped through concrete ducts and out exhaust stacks which line both sides of the building.

Now Alcoa has just expanded this power plant. They have installed 74 new engines—and Westinghouse has supplied 74 more Axiflos. All in all, the 194 fans will move over 2,300,000 cubic feet of cooling air through the generators *every minute*. That's enough air to fill a trainload of 800 boxcars!

One day—today or in the near future—you may have a problem that involves *putting air to work*. When you do, remember that Westinghouse has the most complete air conditioning, air cleaning and air handling line in the industry. See the new Catalog 600. It contains 60 fact-filled pages on products, uses, and helpful data. To get your free copy, just call your local Westinghouse-Sturtevant office. Or, write to Westinghouse Electric Corporation, Sturtevant Division, Hyde Park, Boston 36, Mass.



Axiflo Fans keep them cool. They're compact, efficient, and trouble-free. That's important for hard-to-get-at jobs.

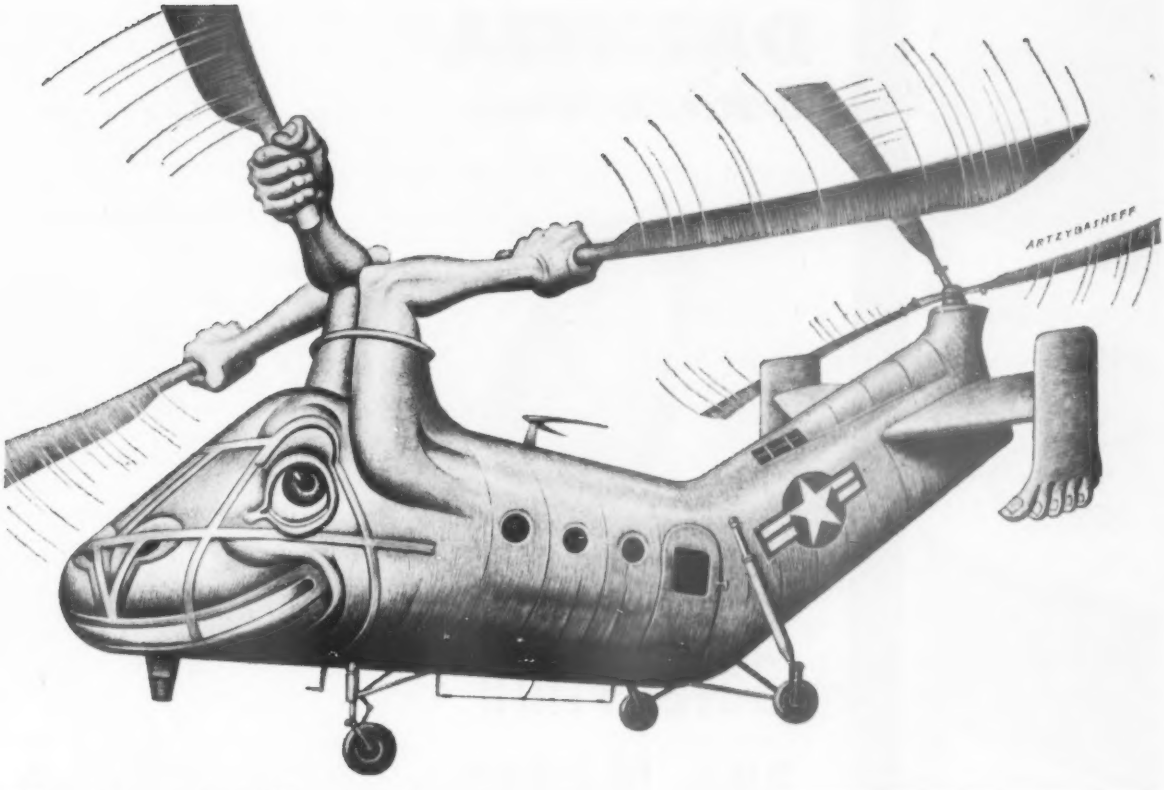


Cooling-air drawn through the engine generators picks up the intense heat, then safely exhausts it through individual stacks.

YOU CAN BE SURE... IF IT'S Westinghouse

J80281

AIR HANDLING



How a helicopter hangs by its "elbows"

Straight up, straight down, forwards, backwards, or just hovering—the Piasecki "Work Horse" Helicopter's peculiar flying maneuverability rests in its rotor assemblies. It is these flexible "elbows" that adjust the pitch of the 'copter's great blades. Each unit involves more than 625 separate parts. To machine and assemble them, Piasecki depends on Lycoming for precision production.

Lycoming stands ready to assist you whether you have a metal product that needs speedy precision or volume fabrication—or "just an idea" in the rough or blueprint stage. Long famous for its metal-working skill, Lycoming continues to meet the most exacting requirements in a wide diversity of fields, both industrial and military. *Whatever* your problem—look to Lycoming!

More than 6,000 machine tools, a wealth of creative engineering ability and 2½ million feet of floor space stand ready to serve your needs.

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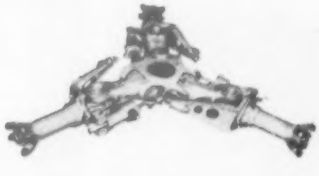
LOOK TO LYCOMING FOR RESEARCH FOR PRECISION PRODUCTION

LYCOMING-SPENCER DIVISION, WILLIAMSPORT, PA.
BRIDGEPORT-LYCOMING DIVISION, STRATFORD, CONN.
AVCO MANUFACTURING CORPORATION

For flexible "elbows" —rotor assemblies that control the maneuvers of its H-21 Helicopter—Piasecki looks to Lycoming's precision production



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BOOKS

For All Plant Executives

AUTOMATION

By John Diebold, Van Nostrand Co., Inc., 250 Fourth Ave., New York. 174 pp. Index. $3.

What is automation? What does it mean to you and what should you be doing about it?

Those are questions that FACTORY has been answering for you since the "Factory of the Future" issue last April. They're also the framework for the ideas you'll find in this informative book.

The author is well qualified to write on automation. He headed up the research group that developed the Harvard report called "Making the Automatic Factory a Reality."

His book will be useful mainly as an orientation lesson on automation. It points up outstanding technological developments, describes the problems you'll face.

The author explains why you must integrate lots of heretofore loosely related plant functions if the problems of the factory of the future are to be licked.

He describes the basic components of the automatic factory: automatic materials handling, feedback controls, the special machines and controls. He gives you an insight into such basic concepts as "unit operations," "operations research," "bundles of functions," and "end-point product control."

Everything is vitally important to you in learning just how far automation has gone today. And it can give you a head start in doing the kind of re-thinking you may soon be called upon to do.

Turn the page

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from **A** *utomotive plants,* **B** *usiness offices,* **C** *hurches and* **D** *epartment stores to* **W** *arehouses,* **X** *-ray manufacturers,* **Y** *acht clubs, and* **Z** *oos . . .*

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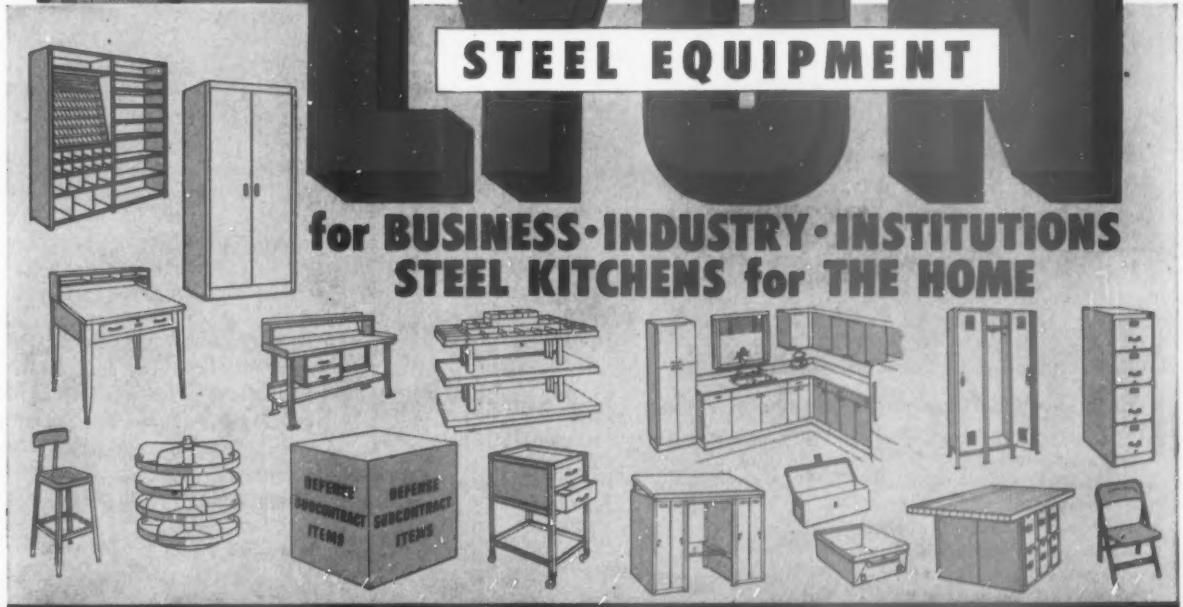

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• Bin Units	• Drawing Tables	• Parts Cases	• Wood Working Benches	• Hanging Cabinets	• Bench Drawers	• Hopper Bins	• Shop Desks

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Original pressure-sensitive tape made in hundreds of widths, weights, constructions for a host of time-saving applications.

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Do you have a defense contract requiring tape to meet government specifications? We can help you.

BUNDLING tools, small parts for packing

SEALING against moisture, oil, salt spray, etc.

BINDING handles, shafts, edges, etc.

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THE SEAMLESS RUBBER COMPANY
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CONVEYOR
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Every Tooth A Vise

in Long Continuous Lengths for Conveyor Belts . . .

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FLEXIBLE STEEL LACING CO., 4678 Lexington St., Chicago 44, Ill.

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BOOKS

Begins on page 316

For Production Executives and Industrial Engineers

HOW TO CONTROL PRODUCTION COSTS

By Phil Carroll. McGraw-Hill Book Co., Inc., New York, N. Y. Charts, tables, references, index. 264 pp $5.

Right now there's plenty of talk about the approach of greater competition in business. When it comes, the knowledge of true manufacturing costs and control of those costs is going to be mighty important.

So now is a good time to see if your cost system is ready for the test.

The author gives some good practical arguments for better cost control, and establishes the need for knowing your true costs to control and reduce them.

The importance of accurately distributing overhead costs to product is thoroughly explained, with examples of wrong and right methods.

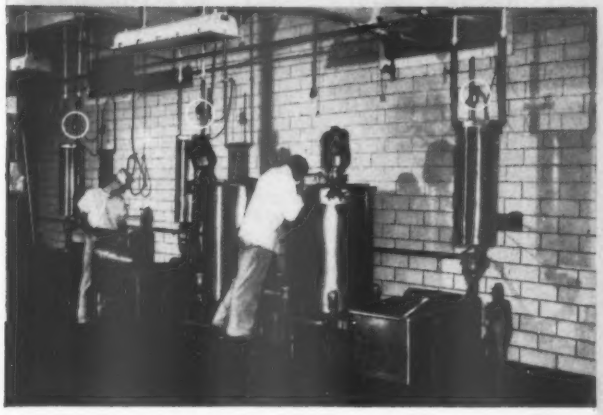
The book explains in detail a system of establishing and controlling product costs. The approach is application of overhead expense in terms of conversion time, and in accordance with rates for different products in a multi-product company.

Five factors are emphasized: Importance of accurate sales forecasts; controlling production to know deliveries, reduce inventory, and shorten the process cycle; saving excess finishes and tolerances with realistic engineering; using incentives; and reporting results promptly.

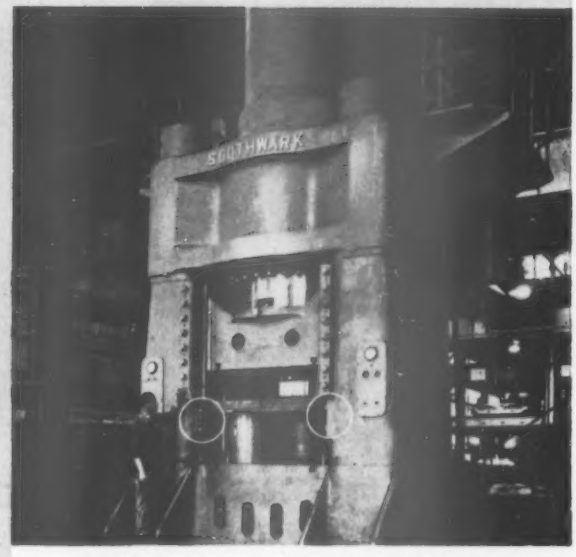
Turn the page

"Electron-eering" *with* photoswitch controls

Your next step in
control-efficiency



Precision for taste— Three electronic liquid level controls maintain the flow of precise quantities of fruit juices for perfect flavoring of jams.



Protection against a giant— Two photoelectric cells control this giant auto body press. If operator's hand breaks light beam, system stops machine.

These facts can save you money . . .

Forty-five case studies, crammed with factual data, tear aside all hocus-pocus and give you a clear understanding of how electronic controls can solve your industrial problems. You'll find valuable ideas in methods by which others have achieved efficiency through "Electron-eered" counting, weighing, measuring, guarding, timing and cycling. (Indexed by industries— textile, paper, metal and others— as well as by applications.)

Photoswitch offices are located in all principal cities

Split-second welding— Electronic timer controls automatic operation precisely. it times and actuates preheat, weld, and postheat annealing.

Photoswitch, Incorporated
Dept. FA 3, 77 Broadway, Cambridge 42, Mass.
Send free, "Cutting Production Costs with Electronic Controls".

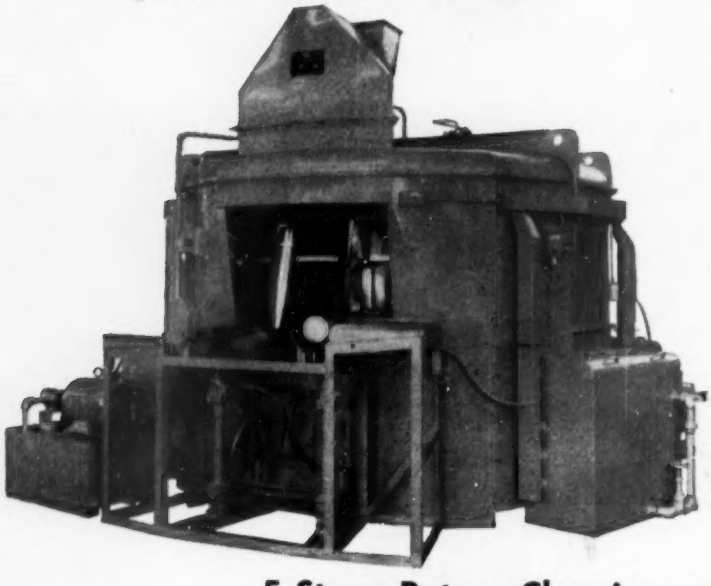
NAME ..... TITLE .....

COMPANY .....

CITY ..... STATE .....

Taken to the Cleaners

by the Turn of a Wheel



5 Stage Rotary Cleaning and Phosphatizing Unit

For: Shells, Shell Casings, Rockets.

Featuring: Automatic Hydraulic Loading and Unloading Device.

Another example of where "chance" has been eliminated. PD Engineers can specify and build Industrial Washers to meet your specific requirements. This Peters-Dalton Industrial Washing Machine has been especially designed to meet a particular customer's needs. The Washer, being rotary in action, occupies less floor space than a conventional straight line machine. In addition to the unit's cleaning action, it etches and gives bonding surfaces preparatory to painting.

Cure-all methods don't work. PD Engineers, with their extensive background of experience and knowledge, are available to discuss your problems for between-operation cleaning or paint preparation. If you would like us to tell you more—write, wire or phone.

Hydro-Whirl Paint Spray Booths *Industrial Washing Equipment*

Drying and Baking Ovens *Hydro-Whirl Dust Collecting Systems*

Peters-Dalton INC.

17918 Ryan Road • Detroit 12, Michigan

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BOOKS

Begins on page 316

Book Briefs

READINGS IN EXPERIMENTAL INDUSTRIAL PSYCHOLOGY

You get an insight into the kinds of questions industrial psychology can answer. Readings are selected from a wide range of published sources on personnel problems, engineering psychology, and individual productivity. Describes psychological methods, applications. By Milton Y. Blum. Prentice-Hall, Inc., 70 Fifth Ave., New York. Case studies, charts, tables, photographs, index. 455 pp. $6.75.

MATERIALS HANDLING IN INDUSTRY

Which materials handling device to use where? Here are complete descriptions of types of equipment and applications. Covers overhead runways and lifting equipment, cranes, conveyors, elevators, transport and storage, and other types of equipment. By British Electrical Development Assn. 2, Savoy Hall, London, W. C. 2, England. Drawings, photographs, charts, index. 142 pp. $1.19.

SIX WAYS TO RETIRE

Ideal reading here for anyone who's getting ready for retirement.

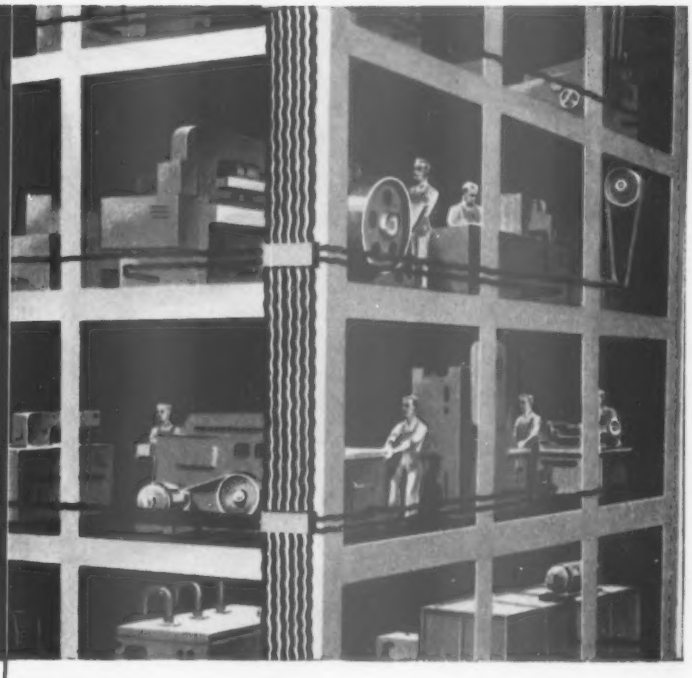
When you retire, says the author, make sure you have a plan for rewarding activity. The book is packed with practical ideas on six paths to choose from. Also hints on how to pay your way, how to choose a place to live, how to discover hidden talents. By Paul W. Boynton, Harper & Bros., 49 E. 33rd St., New York. 145 pp. Index. $2.50.

Turn the page

NEED NEW LIFE
IN YOUR
UNDER-POWERED
BUILDING?

GET UP TO 50% ADDITIONAL POWER

WITH
ROCKBESTOS A.V.C.®
WITHOUT REPLACING
PRESENT CONDUIT



Here's How You Benefit

Use Same Size Cable . . . get ⅓ to ½ more current.

Use Present Conduit and Fittings . . . save on steel.

Installation Costs Are Low . . . cable size remains the same, is easy to pull through conduit. Using present conduit eliminates costly installation.

No Building Repairs . . . because you use existing conduit, there are no walls to repair, no weakened beams or partitions to repair.

A Time Saver . . . Old buildings or new, Rockbestos A.V.C. is a dollar-saver, and time-saver. Write for booklet "Rx for a Building with Hardening of the Electrical Arteries."

Have electrical loads outgrown your power requirements? You can increase your capacity up to 50% by merely replacing the present cable with Rockbestos A.V.C. . . . *the cable with the higher ampere rating.*

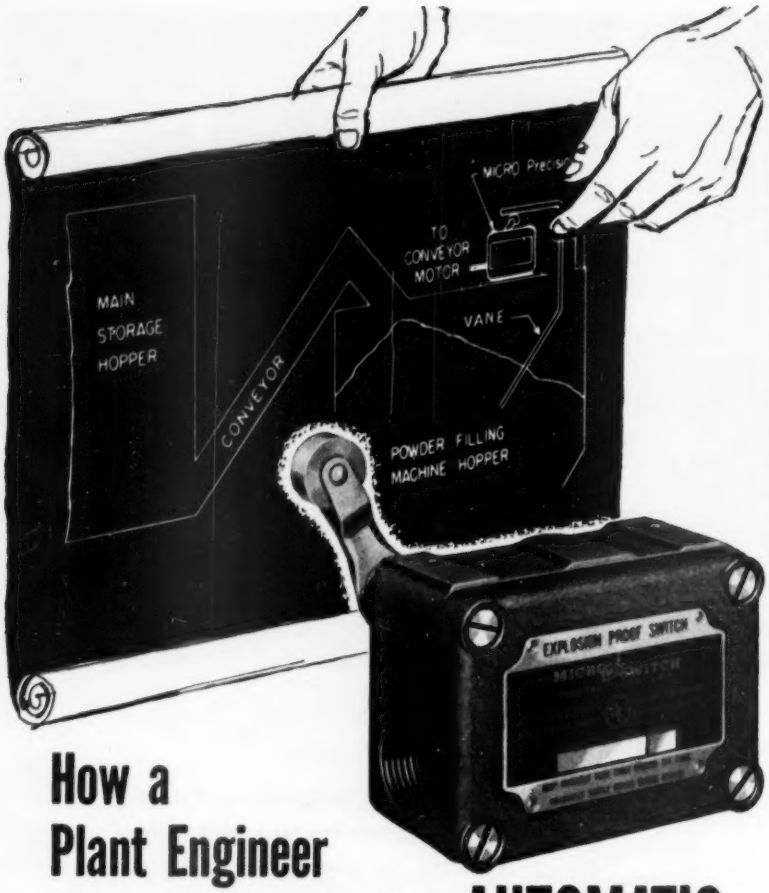
IT'S THE **A.V.C.** "SANDWICH" THAT MAKES THE DIFFERENCE

This "sandwich" protects the varnished cambric. It enables A.V.C. to carry more current than cables with conventional insulations.

Outer Felted Asbestos Wall	Varnished Cambric	Inner Felted Asbestos Wall

ROCKBESTOS PRODUCTS CORPORATION
NEW HAVEN 4, CONN. • the originators of **A. V. C.®**
New York • Cleveland • Detroit • Chicago • Pittsburgh • St. Louis
New Orleans • Los Angeles • Seattle • Oakland, California

Hi ... *Your best buy*



How a Plant Engineer made hopper-loading AUTOMATIC ...with a MICRO switch

● A Midwestern plant engineer installed an explosion-proof MICRO switch in the motor circuit of his powder loading conveyor.

As the hopper fills to the predetermined point, pressure of a pivoted actuating vane in the machine hopper operates the switch and halts the conveyor bringing powder from the main storage hopper.

This simple but important installation is typical of the thousands of uses that plant engineers are making every day of these versatile, precise snap-action switches to make present equipment safer, more automatic and more productive.

If you are looking for new ways to make existing plant equipment safer and more automatic, you will find a MICRO Authorized Distributor located near you with a full line of switches to meet a wide variety of applications. Look in your classified telephone directory under "Switches, Electric." Write for MICRO TIPS . . . a veritable gold mine of practical switch application ideas. We'll be glad to put you on the mailing list to receive it regularly.

MICRO MAKERS OF PRECISION SWITCHES
FREEPORT, ILLINOIS
A DIVISION OF MINNEAPOLIS-HONEYWELL REGULATOR COMPANY

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BOOKLETS

Begins on page 316

PERSONNEL ADMINISTRATION. By Clark C. Sorensen. Bellman Publishing Co., 83 Newbury St., Boston 16. If you want to know what personnel administration is all about and what opportunities there are in the field, this booklet is for you. 24 pp. 75¢.

INDUSTRIAL SECURITY. National Industrial Conference Board, 247 Park Ave., New York 17. How are you protected against subversion and sabotage? Several case studies show what you can do in protecting against security risks, getting them off the payroll. Available to NICB members and associates. 88 pp. $2.

HOW TO GET LONGER SERVICE FROM YOUR PUMPS. The International Nickel Co., 67 Wall St., New York 5. Corrosion, corrosion fatigue, and wear cut pump life. This booklet tells how special alloys can check them. 8 pp. Free.

TRAINING FOR INDUSTRIAL ACCIDENT PREVENTION. By Walter A. Cutter & J. Duke Elkow. Center of Safety Education, Division of General Education, New York Univ., Washington Square 3, N. Y. Describes what courses colleges might be expected to offer in industrial accident prevention. 64 pp. Free.

HANDBOOK OF MANUAL MATERIALS HANDLING EQUIPMENT. By Market & Product Research Committee, Floor Truck Mfrs. Assn., 27 E. Monroe St., Chicago 3. Here's help on selecting and using manual materials handling equipment. Or in getting ideas for new applications of equipment you already have. 48 pp. $1.

BENJAMIN "Magna-Flo" Systems Excel!

that's why Overall Lighting Costs are LOWER!

Because Benjamin "Magna-Flo" Systems excel by every Quality Standard—lighting, electrical and constructional—they can provide high illumination levels at low overall lighting cost. Such cost involves more than the original price of the units. Overall lighting cost also includes the costs of installation, operation, maintenance and replacement. Add them all up and see why you're ahead with "Magna-Flo" Systems (individual unit or continuous line)—because "Magna-Flo" excels by ALL QUALITY STANDARDS!

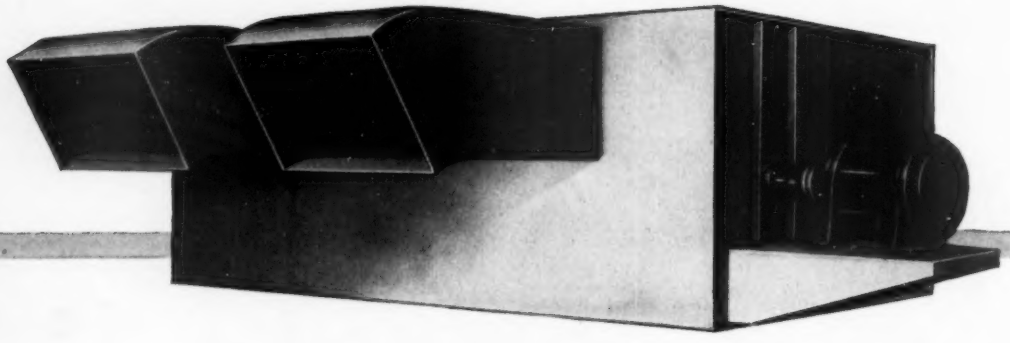
This chart gives some of the important reasons why:

"MAGNA-FLO" CUTS INSTALLATION COST	"MAGNA-FLO" CUTS MAINTENANCE COST	"MAGNA-FLO" CUTS OPERATION COST	"MAGNA-FLO" CUTS REPLACEMENT COST
wide variety of knockouts facilitate wire entrances into unit.	Porcelain Enamel reflecting surface is easy to keep clean with soap and water.	made for efficient utilization of high light output T12 Slimline lamps.	famous Benjamin "built-like-a-battleship" construction of heavy gauge steel.
complete line of sliding hangers.	exclusive "Springlox" lampholders make possible "quick-in, quick-out" lamp maintenance.	high power-factor ETL-approved ballasts for continuously-cool, efficient operation.	rigid channels and reflectors withstand toughest industrial vibration.
single, rugged channel coupling for continuous mounting.	Speedy, exclusive "Lok-Latch" reflector fasteners.	high reflection factor remains constant because genuine Porcelain Enameled reflector does not discolor or become dull with age.	96" reflectors are made in two sections, kept perfectly aligned by positive alignment clips.

FREE Bulletin AD-5705 brings you complete specifications on Benjamin "Magna-Flo" Lighting Systems—famous for "Task-Matched" Lighting Installations. Benjamin Electric Mfg. Co., Dept. N, Des Plaines, Ill.

Benjamin "Magna-Flo" Systems are Sold Exclusively through Electrical Distributors

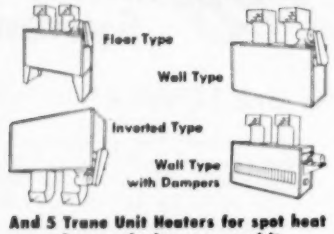
Here's why Trane Torridors can be tailored to fit so many heating jobs!



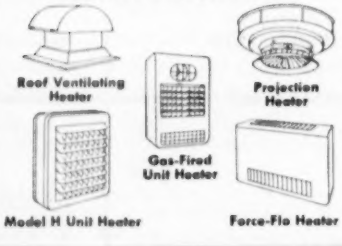
These *standard* TRANE accessories can be combined with any *standard* TRANE Torridor to solve any heating, ventilating, air filtering or process problem.

- **Many coil types . . .**
  High or low pressure steam—Hot water —Standard or "non-freeze" SD type
- **20 Nozzle arrangements**
- **Wide choice of filters and frames**
- **Two types of by-pass dampers**
- **Mixing and intake boxes**

4 More Standard Torridor Models



And 5 Trane Unit Heaters for spot heat where and when you need it.



How you can have Engineered Heating to solve problems like these with a standard TRANE Torridor!

1. Drafty doorways. Use basic Torridor heating section with nozzles and door switch. Positive blanket of heat every time door opens.

2. Negative pressure. Use Torridor with SD "non-freeze" coils and filter section to introduce fresh tempered air. Maintain positive pressure. Eliminate cold air leaks.

3. Close temperature control. Use Torridor with face-and-by-pass and/or modulated steam distributing coils. Tempers chilly morning air . . . permits mild midday air to enter without overheating.

4. Explosive atmosphere. Use Torridors with spark-resistant fans and explosion-proof motors. Many other variations available.

5. Need for quick warm-up. Use mixing box on Torridor. Fresh air dampers close for quick warm-up—modulate to mix ventilation air with room air.

6. Process heating or drying. Torridor has ample room for three rows of high output coils for process heating or drying applications.

7. Compact central system. The powerful centrifugal fans of the Torridor can deliver large quantities of air through duct systems.

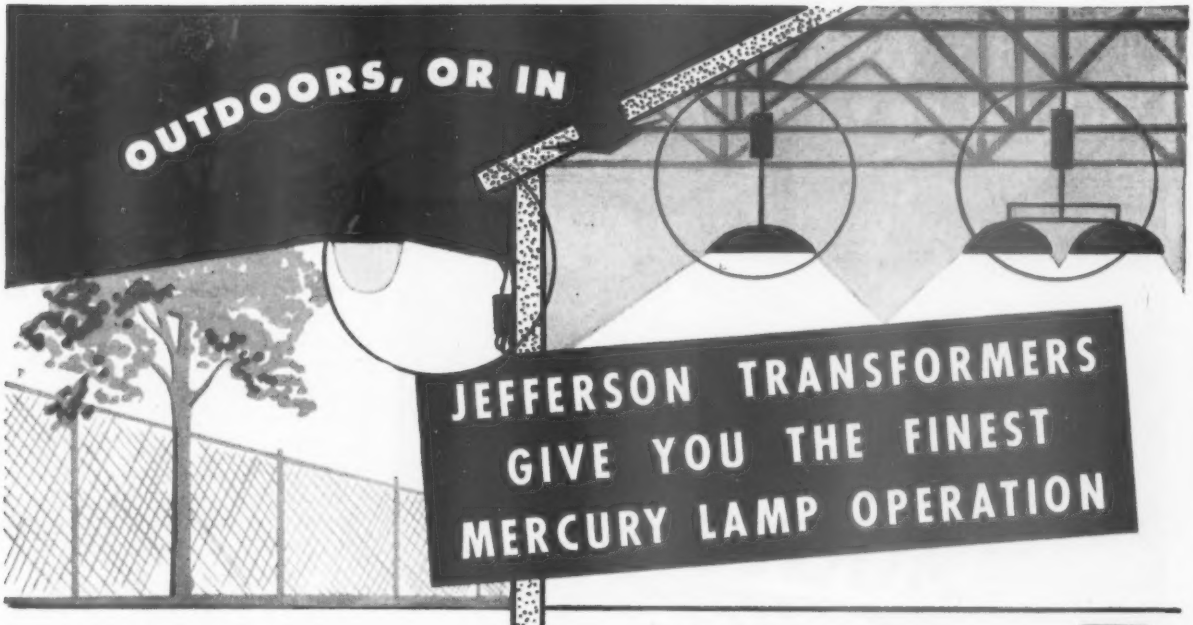
8. Ventilation. Use Torridors for ventilation all year. In the summer, Torridors circulate outside air. In the winter, tempered air.

Problems of fog removal, ice melting, drying, curing and many others can be solved with TRANE Torridors . . . automatically, with standard pneumatic or electrical controls. See your consulting engineer or TRANE office. Write TRANE, La Crosse, Wis., for Bulletin DS-327A.

TRANE Torridors

The Trane Company, La Crosse, Wisconsin • East. Mfg. Div., Scranton, Pennsylvania
Trane Company of Canada, Ltd., Toronto • 80 U.S. and 14 Canadian Offices

TRANE—MANUFACTURING ENGINEERS OF HEATING, VENTILATING AND AIR CONDITIONING EQUIPMENT.



JEFFERSON TRANSFORMERS GIVE YOU THE FINEST MERCURY LAMP OPERATION

FOR OUTDOOR SERVICE

The finest transformers for outdoor operation of all H-1 400 watt mercury lamps. From core and coil to seamless hot-dipped galvanized case, every modern design and construction feature has been built in for longest transformer life and maximum lamp performance.

Every Jefferson Transformer is engineered to the highest quality standards. All are in deep drawn *weatherproof* cases for years of positive protection against the elements. Each has *all* the extra value features found *only* in Jefferson Transformers.

Streamlined hot-dipped galvanized case sheds water like a duck. No seams, no cracks, no place for moisture to seep in. Welded bracket has keyhole slot for easy mounting. Dura-Gray harmonizing finish for modern, attractive installations.

Large handhole gives easy access to color-coded tagged leads. Correct installation is quick, positive.

Patented Jefferson Adaptor converts wall and post mounting transformers to pole top units in minutes. Transformer stocks can be cut drastically as one type transformer can be mounted wherever needed—wall, post, or pole-top with an adaptor.

Universal Adaptor fits any pole top from 2-1/2" to 4" O.D. — fills every need. It's inexpensive, easy to mount. Provides a solid, weatherproof base for the transformer. Comes fully equipped with outlet fittings.

FOR INDOOR SERVICE

Jefferson two-lamp transformers cut installation costs by reducing wiring up to 50%. High power factor design delivers maximum lumens per watt. Failure of one lamp does not affect the operation or brilliancy of the remaining lamp. Stroboscopic effect is minimized since the two lamps operate out of phase with each other.

Mercury and incandescent lamp wiring facilities are provided at both ends in ample wiring compartments. Leads are color-coded and tagged. One-half and ¾" knockouts are provided in both sides of each wiring compartment and in both end plates for trouble free wiring. Condenser is mounted in a separate compartment for efficient cooling and maximum life.

TWO-LAMP TRANSFORMER

Jefferson Single Lamp Transformers give you every vital feature for top-notch lamp operation and economy. Press-fit riveted core, double varnished core and coil assembly, three primary taps (not just two), easy mounting brackets, and incandescent as well as mercury lamp leads out of both ends are a few of the outstanding Jefferson features. You get all these extra values in Jefferson Transformers, yet they cost no more than ordinary transformers.

Specify Jefferson for the best operation of every mecury lamp installation. New 16-page illustrated Bulletin 521-5 gives complete data on H-1 400 watt models as well as the new Jefferson Transformers for H-12 and H-15 1000 watt mercury lamps.

SINGLE LAMP TRANSFORMER

JEFFERSON ELECTRIC COMPANY
BELLWOOD, ILLINOIS

Jefferson Transformers

PUT THIS 2-WAY SAFETY METHOD TO WORK ON YOUR CONCRETE FLOORS

MULTI-CLEAN *Method*

1. Greater Working Safety!
MULTI-CLEAN HARDENER and ETCHER
MULTI-CLEAN CONCRETE PRESERVER

Today, hundreds of concrete floors in the Petroleum Industry are being given longer life, lasting color and they are providing greater safety for the people who use them.

The tested and proved Multi-Clean Method insures this all-around floor safety and protection by producing a hard, deep etched floor with a completely sealed surface that is non-slip and impervious to abrasion, water, oils, grease, alkali and soaps. Floors are easier to clean and stay clean longer. A choice of six non-fading, non-peeling colors add new beauty and attractiveness.

2. Greater Maintenance Safety!
MULTI-CLEAN Explosion Proof FLOOR MACHINE

Floor maintenance in hazardous areas has now been made safe and easy with the Multi-Clean Explosion Proof Floor Machine. This machine is approved explosion-proof by U/L for Class 1, Group D hazardous locations. It can be used to scrub, wax, buff and polish floors anywhere in the plant without danger of causing fire or explosion.

With the Multi-Clean Explosion Proof Floor Machine you can mechanize all your floor maintenance operations with utmost safety. You can have more attractive floors, yet cut time and costs of floor upkeep to a bare minimum. For more details write:

MULTI-CLEAN PRODUCTS, INC., Dept. FM-3
2277 Ford Parkway, Saint Paul 1, Minn.

FREE!
Floor Care Handbook

Upon request you will receive this 44-page illustrated handbook jam-packed with tested and proved ideas on floor care, also complete information on Multi-Clean floor liquids and equipment to meet every need.

THE MULTI-CLEAN METHOD: The Only Complete Floor Maintenance Program Available Through Authorized Distributors Evrrywhere.

INDUSTRIAL FILMS NOW AVAILABLE

"SMALL BUSINESS AND THE AIR FORCE" is designed to show small business men how to seek Air Force business with a minimum of time and effort. The 22-min. sound film is available from:

Wright - Patterson Air Force Base, Ohio. Attn: Industrial Liaison Officer, Director of Procurement and Production, Symbol No. NCPAXC-1.

"CHUCK HANSEN—ONE GUY" is a 26-min. color film that outlines an in-plant project to combat prejudice. You watch factory people try to achieve better understanding. Write:

National Conference of Christians & Jews, 381 Fourth Ave., New York 16.

"PICK YOUR SAFETY TARGET" points up the foreman's key position in detecting accident causes and taking corrective action. Describes a 3-step plan to cut down plant accidents. For rent at $5. For sale at $52. Write:

National Safety Council, 425 N. Michigan Ave., Chicago 11.

"PORTRAIT OF AN ENTERPRISE" shows on-the-job scenes in four divisions of an engineering company. Covers riverboat and barge construction, heavy construction projects, and dredging up sand. 30 minutes, color. Write:

Advertising Dept., Dravo Corp., Neville Island, Pittsburgh 25.

"IT'S ONLY THE BEGINNING" is a 10-min. blending of live action and cartoons on the value of industrial research. Since the source of research funds is company profits, the importance of the latter is also made clear. Color. For sale at $125 from:

National Education Program, Harding College, Searcy, Ark.

Turn the page

UNSURPASSED FOR

LOADING GONDOLAS

LOADING VAN TRUCKS

HANDLING BULKY OBJECTS

LOADING FOR EXPORT

EMERGENCY LIFTING

CLOSE QUARTER OPERATIONS

5th NATIONAL
MATERIALS HANDLING EXPOSITION
MAY 18-22, 1953
PHILADELPHIA

HYSTER

The more you use it...the more uses you find for it!

The Hyster Karry Krane rides smoothly on big pneumatic tires, and handles as easily as a truck. Gasoline-engine driven. Conventional controls. Turns around within its own length!

HYSTER KARRY KRANE®

10,000 LBS. CAPACITY

"I've bought my third Karry Krane, and I still don't have one around, because other departments keep borrowing it. I'm going to order another," one superintendent* says, and many companies have this experience after buying a Karry Krane.

If you have yard operations of any sort, loading or unloading gondolas or flatcars, large bulky objects to handle and store, the Hyster Karry Krane is your most profitable solution. Because it handles load units not profitably handled by other types of materials handling equipment, the Karry Krane is a perfect complement to any lift truck fleet operation.

The Hyster Karry Krane costs little to operate. It pays for itself in a short time, depending on the operation, then keeps on saving and making money for you afterwards. With a Karry Krane on your premises, you can be sure of handling any tough load profitably. *For details, write today for Catalog 1236 to:*

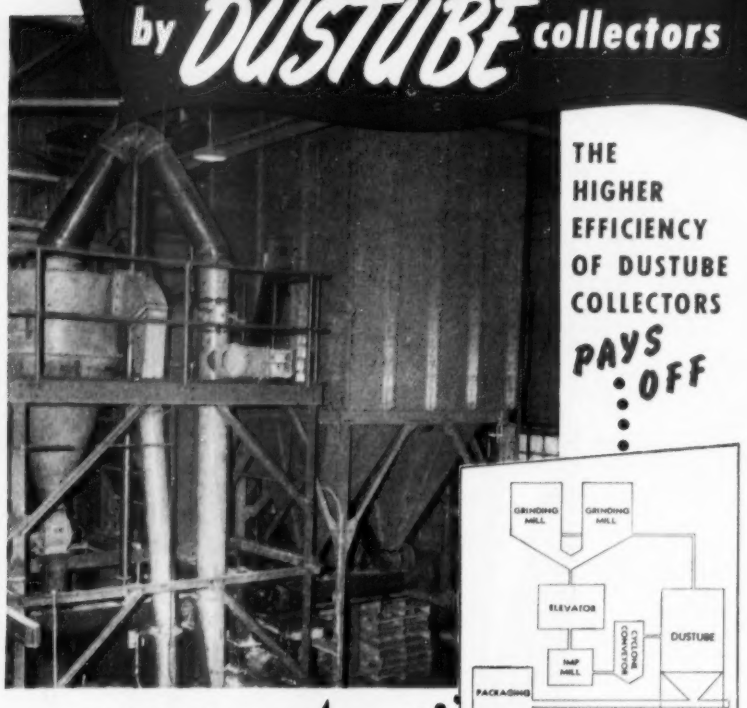
Hyster Co., 2956 N. E. Clackamas Street, Portland 8, Oregon.

*name on request

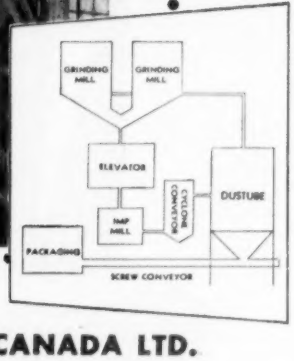
THERE'S PROFIT IN HYSTER POWER

HYSTER COMPANY FOUR PLANTS: Portland, Oregon • Peoria, Illinois • Danville, Illinois • Nijmegen, The Netherlands

ANOTHER DUST PROBLEM SOLVED by DUSTUBE collectors



THE HIGHER EFFICIENCY OF DUSTUBE COLLECTORS PAYS OFF



for WILLARD STORAGE BATTERY CO. of CANADA LTD.

The manufacture of lead oxide for storage battery plates at the Willard Storage Battery Company of Canada, Limited, requires extensive dust control equipment. Recent process modifications, together with an expansion program, made it necessary for Willard to replace older collectors with a Dustube Collector.

The Dustube Collector was selected because of its very high efficiency. Even very fine lead oxide dust is collected with virtually 100% efficiency. Collected material is automatically discharged into a screw conveyor and delivered to the packaging station. The lead oxide is recovered in its dry natural state so it can be used without further processing, filtering or drying.

This is just one example from hundreds showing that Dustube Collectors remove dust more thoroughly at lower cost. It will do the same for you. *Write for Catalog 372 today!*

American
WHEELABRATOR & EQUIPMENT CORP.
374 S. Byrkit St. Mishawaka, Indiana

dustube COLLECTORS

INDUSTRIAL FILMS NOW AVAILABLE

Begins on page 326

"THE SKY IS THE ROOF" features a weather-protected motor for outdoor service. Shows how no water gets inside even after motor is deluged by heavy wind-driven rain. The color film runs 12 minutes. Available for free showing from:

Allis-Chalmers Mfg. Co., General Machinery Div., Milwaukee.

"A GRAY DAY FOR O'GRADY" uses a series of comedy situations to dramatize the high cost of accidents. O'Grady, the new foreman, learns that it takes time and money to prevent accidents, but that having accidents takes more of both. For rent at $5. For sale at $52. Write:

National Safety Council, 425 N. Michigan Ave., Chicago 11.

"SAFETY SAVES" illustrates the do's and don't's of safe industrial truck driving, shows the causes of most accidents and how to prevent them. You watch Willie the Cowboy, who doesn't follow the rules, make one mistake too many. He's carried away on a stretcher. The sound film runs 30 minutes. Write:

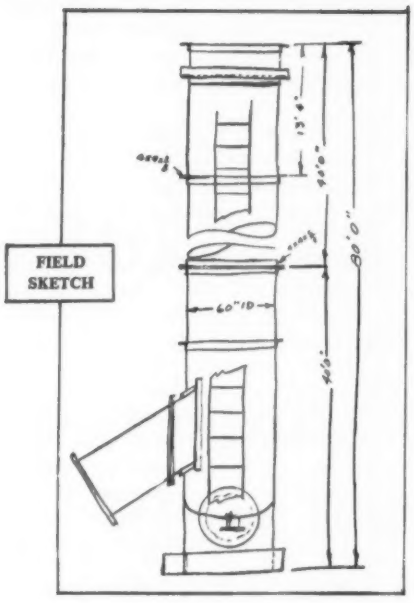
Clark Equipment Co., Industrial Truck Div., Battle Creek, Mich.

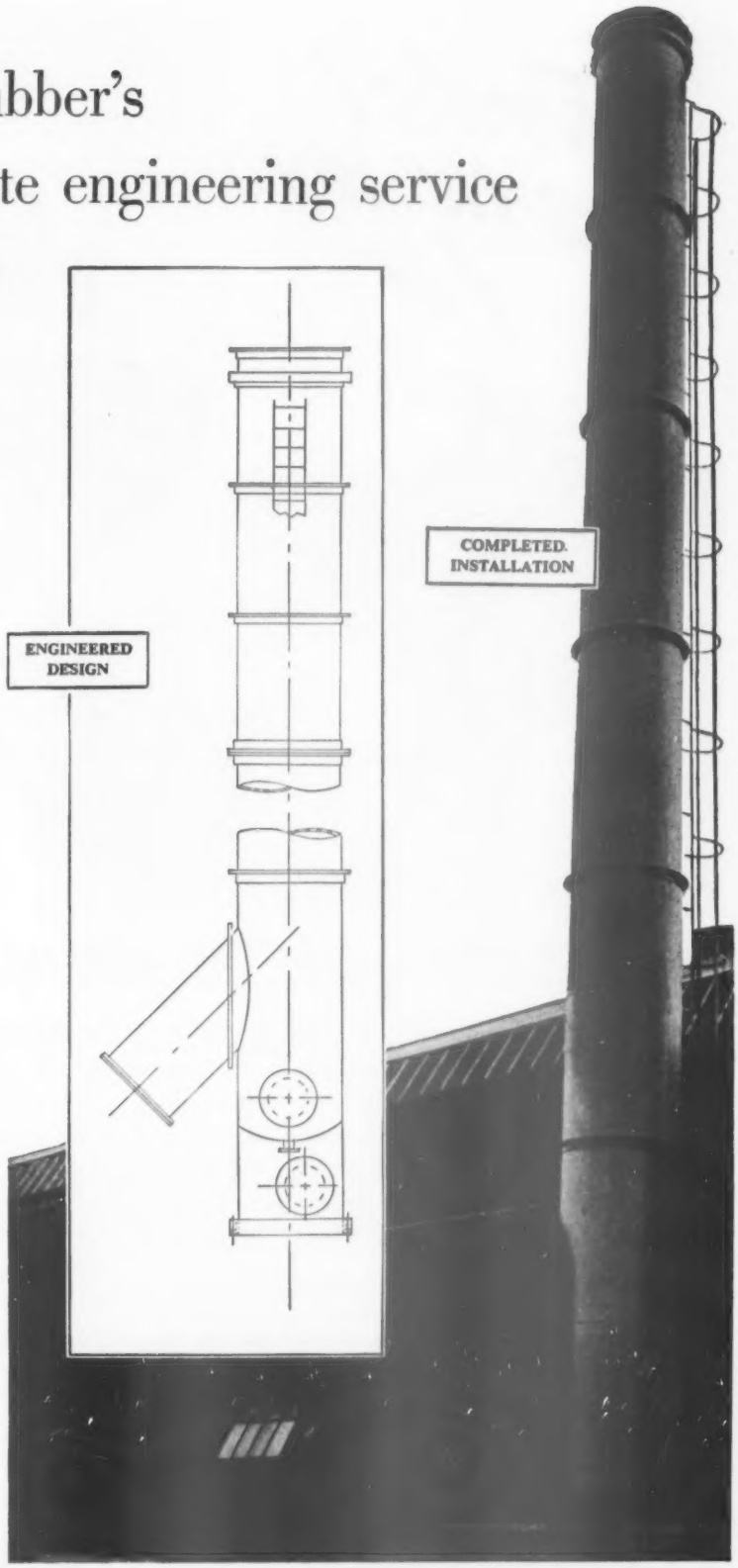
TRAINING IN ARC WELDING is subject of three color slidefilms. "Electric Arc Welding and How it Helps Man," "Selecting and Using Arc Welding Equipment Safely," and "Practical Arc Welding." Sequences are designed to supplement and illustrate instruction and demonstration. Comes with manual. For sale at $19.50 for the set of three films and manual. Write:

Lincoln Electric Co., 22801 St. Clair Ave., Cleveland 17.

Turn the page

How U. S. Rubber's complete engineering service combats corrosion





This steel mill was faced with the difficult problem of exhausting corrosive gases resulting from its pickling operations. A U.S. Rubber engineer was consulted, and he designed this rubber-lined steel stack. 80 feet high and 5 feet in diameter.

Fabricated, rubber lined and installed under his supervision, its successful operation serves as one more positive example of the complete engineering service available to industry to combat corrosion. Write to address below.

PRODUCT OF U.S.RUBBER SERVING THROUGH SCIENCE

UNITED STATES RUBBER COMPANY

MECHANICAL GOODS DIVISION • ROCKEFELLER CENTER, NEW YORK 20, N. Y.

Terrific! is the word for

"Automatic" SPRAY Sprinklers

TERRIFIC . . . That's the word that insurance underwriters use in describing the new "Automatic" SPRAY Sprinkler.

It's a "Sure Fire Killer", designed for quick action and maximum effective distribution of water.

Property owners get protection-PLUS in all types of buildings with this vastly improved fire fighter that can be installed on both exposed and concealed piping systems. And . . . "Automatic" SPRAY Sprinklers are easily interchangeable with obsolete devices . . . cost no more than old style sprinklers.

This important advancement in the science of fire safety is further reason why "Automatic" Sprinkler is universally recognized as FIRST IN FIRE PROTECTION!

New literature available on request

"Automatic" Sprinkler

CORPORATION OF AMERICA · YOUNGSTOWN, OHIO

OFFICES IN PRINCIPAL CITIES OF NORTH AND SOUTH AMERICA

FILMS ... *Begins on page 326*

FILM PROGRAM OF THE MONTH

EMPLOYEE RELATIONS PROGRAM

Here's a list of films to help you explain to plant people how employee relations programs work. You can use them to supplement the material in the story on small-plant employee relations (page 102). Films were selected for FACTORY's readers by specialists at the Audio-Visual Center, Washington State College.

"UNDER THE STARS" shows and explains the policies of employee relations in a large manufacturing company. Illustrates items considered for the comfort and well being of the employee at work: suggestion plans, employee advancement, profit sharing, security plans, pension plans, disability plans, stock purchase plans, compensation, vacations, hospitalization, safety and company-sponsored recreational programs. This film would be of interest to management for orientation. 30 minutes, sound, color. Write:

Procter & Gamble, Box 599, Cincinnati 1.

"FOR YOUR BENEFIT" uses dramatization to explain such items as benefits, limitations, participation, and length of company service. Uses an interview situation to clarify the explanation of the plan. Compares the benefits of the company with other plans. A good film for the use of management, if contemplating the formulation of such a plan. 24 minutes, sound. Write:

American Telephone and Telegraph Co., Film and Display Div., 195 Broadway, New York 7.

"FIFTY-TWO PAYCHECKS EACH YEAR" describes how labor and management were able to agree on a policy whereby the employees would share in the profits of the company. Explains the

IN BINS

or

BOXCARS

PAYLOADERS

Blast Bulk Handling Costs

Scoop-up? Carry? Dump? Spread? Load? Pile? Pour? . . . "PAYLOADER" tractor-shovels will do all of these bulk material handling jobs for you and many more . . . up to three tons at a time . . . travel at speeds up to 28 miles per hour . . . work inside buildings or outside on pavement or ground.

"PAYLOADERS" bring a combination of speed, low cost, flexibility and versatility to your bulk-handling problems unmatched by any other type of equipment. Thousands of "PAYLOADER" installations in all kinds of plants and situations have accomplished tremendous cost reductions through savings in time and labor and through increased production.

Our broad experience, plus that of your Hough Distributor, is available to help solve your bulk material handling problems, and without obligation. The Frank G. Hough Co., 755 Sunnyside Ave., Libertyville, Ill.

FREE HANDBOOK

Tells how and where to look for signs of inefficient bulk materials handling . . . how to analyze, organize and set up an efficient handling system. Plus many useful tables and data. Write for "Bulk Materials Handbook."

SAY "HUFF"

PAYLOADER®

THE FRANK G. HOUGH CO. SINCE 1920

HOW YOU SAVE,
Getting Drier Compressed Air

● Direct saving in the cost of cooling water saves the price of the Niagara Aero After Cooler (for compressed air or gas) in less than two years.

Extra, for no cost, the drier air gives you a better operation and lower costs in the use of all air-operated tools and machines, paint spraying, sand blasting or moisture-free air cleaning. Water saving also means less expense for piping, pumping, water treatment and water disposal, or you get the use of water elsewhere in your plant where it may be badly needed.

Niagara Aero After Cooler assures all these benefits because it cools compressed air or gas below the temperature of the surrounding atmosphere; there can be no further condensation in your air lines. It condenses the moisture by passing the air thru a coil on the surface of which water is evaporated, transferring the heat to the atmosphere. It is installed outdoors, protected from freezing in winter by the Niagara Balanced Wet Bulb Control.

Write for complete information; ask for Bulletin No. 98

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Over 35 Years of Service in Industrial Air Engineering

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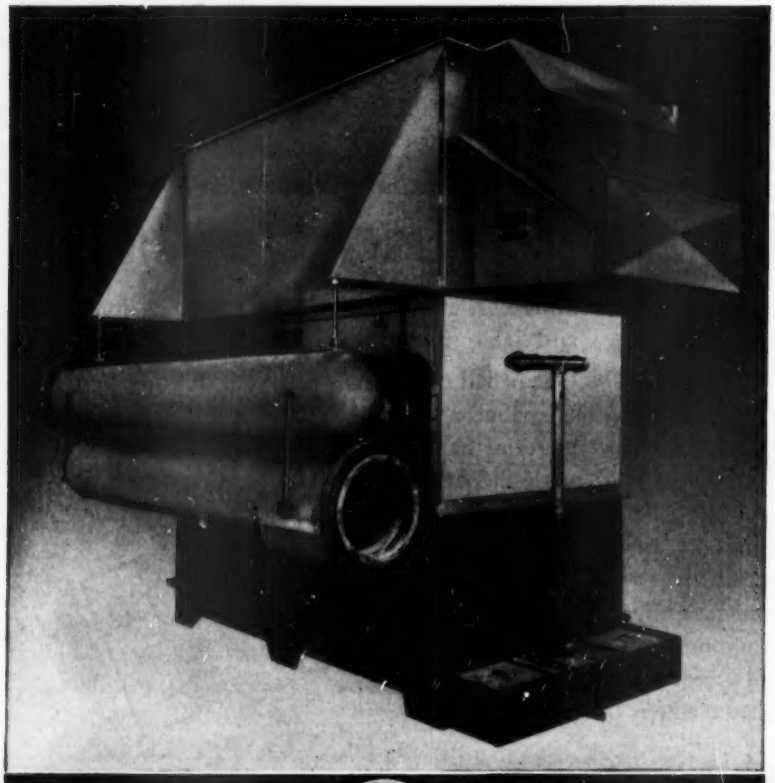
District Engineers in Principal Cities in U.S. and Canada



INDUSTRIAL COOLING HEATING • DRYING

NIAGARA

HUMIDIFYING • AIR ENGINEERING EQUIPMENT

FILM PROGRAM OF THE MONTH

Begins on page 330

rights of the union in shaping company plans. Discusses recreation, vacations, and sick benefits for employees. 25 minutes, sound. Write:

Nunn-Busch Shoe Co., Milwaukee 1.

"WORKING TOGETHER" suggests methods of maintaining good employer-employee relations. This film takes one particular employee through the hiring process, explaining how the company personnel records are kept, also the company's advancement policies and benefits. Stresses keeping the employees informed of what the company is doing through bulletin boards and a company newspaper. Briefly shows social activities enjoyed by the employees and presents a statement of management's pledges to the workers. 33 minutes, sound, color. Write:

Thompson Products Inc., Cleveland.

"EMPLOYEES' THRIFT PLAN" is a brief film consisting of drawings and cartoons illustrating the highlights of retirement and investment plans available in company. Explains annuity and savings plans. An easy-to-understand film that management could use in considering such a plan for its own company. 8 minutes, sound, black and white. Write:

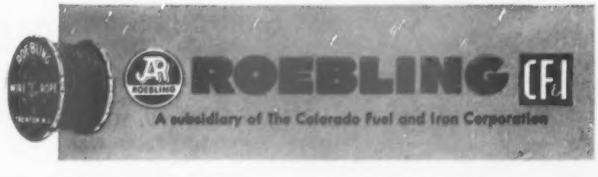
Standard Oil Co. of New Jersey, 30 Rockefeller Plaza, New York.

"THE FUTURE IS WHAT YOU MAKE IT." is a fantasy set in the year 2000. The film consists of a series of still cartoons on retirement and group life insurance. Explains the benefits derived by employees, stresses the company's role. 15 minutes, sound, color. Available free from:

Ethyl Corp., 100 Park Ave., New York 17.

IT'S JUST THAT SIMPLE. There's only one reason in the world why 2 out of 3 wire rope users in the industrial field prefer Roebling wire rope... *it costs a lot less on the job than any other.*

For maximum wire rope efficiency and economy, call your nearest Roebling office for a Field Man. He'll recommend the best ropes for your operations.



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Quaker hose can take it!"

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Write for name of nearest Quaker distributor

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Sterling Supreme Gummed Tape

PEOPLE MAKE THE BIG DIFFERENCE . . . All gummed tapes look much alike . . . but there's a real difference. Through the experience and ingenuity of The Gummed Products Company's Director of Research (shown here), Sterling Supreme Gummed Tape standards are maintained—and constantly improved.

Passes 46 Tests*

from raw material to finished product

Our laboratory staff is everlastingly testing new materials, new formulae, new methods, to keep the quality of Super-Standard Sterling Supreme Gummed Tape *the highest of all brands.*

First, the kraft purchased from the world's finest mills must pass 18 tests in our laboratory. Then it is gummed and processed on the industry's most modern equipment with up to 7 tests of the glue, 3 of the materials while in process, ending with 18 different tests of the finished tape—46 in all.

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Sterling Supreme costs less in the most important place—the Shipping Room!

*A complete list of the 46 tests will be supplied on request.

GUMMED PRODUCTS COMPANY

BEHIND THE BYLINE

Meet some of the men in industry who wrote articles for this issue of FACTORY.

ALLEN G. ERDMAN (page 138) describes fork truck operator-training at Monsanto Chemical Co.'s Springfield, Mass., plant. Now superintendent of transportation and materials, he's held down research, engineering, and production assignments.

SEBASTIAN A. MARINO (page 138) is co-author of the fork truck training article. His position: area supervisor of the materials handling, warehouse, and truck fleet departments at Monsanto's Plastics Division.

JAMES S. MASSIE (page 110) writes about in-plant training for better reading at Micro, a division of Minneapolis-Honeywell Regulator Co. He's been active for several years in design and production engineering, is now a staff assistant.

Turn the page

New G-E Motor Control Center Has Easiest-to-Interchange Units

The new General Electric motor control center is the most up-to-date equipment for the centralized control of a-c motors up to 200 horsepower. Each control center is planned for the job it is to handle, but it can rapidly be modified to meet changed requirements. Standard units can be easily interchanged or substituted, new units can be quickly added. Units may be mounted back-to-back in same standard enclosure. Master terminal boards may be located at either top or bottom of cabinet.

ACCESSIBLE. Installation is simple—just a matter of sliding the unit into its compartment. Stab-on connectors grab the vertical bus. Wiring is easy because even pushbuttons and terminals are mounted on the unit frame for simple front-connecting. Doors swing more than 90°, so unit can be lifted out of compartment for accessibility from all sides. Barriers between units can be slipped out, making a four-inch wiring trough. Master terminal boards can be swung out of place for connecting without "fishing" of wires.

FOR MORE INFORMATION, contact your nearby General Electric apparatus sales office, authorized G-E agent or distributor, or write Section 781-1 for GEA-4979A today. *General Electric Company, Schenectady 5, New York.*

INDIVIDUALLY PLANNED motor control centers are manufactured and delivered completely wired and ready-to-install from this new General Electric motor control center production line.

EASY TO INSTALL, inspect, and interchange starters, which are assembled as complete units, including pushbuttons and wiring terminals for easy front-connecting. Door swings more than 90°

HIGH POTENTIAL TESTS are made of each completed General Electric control center before shipment, to assure adequate short-circuit protection, safety for plant personnel and equipment.

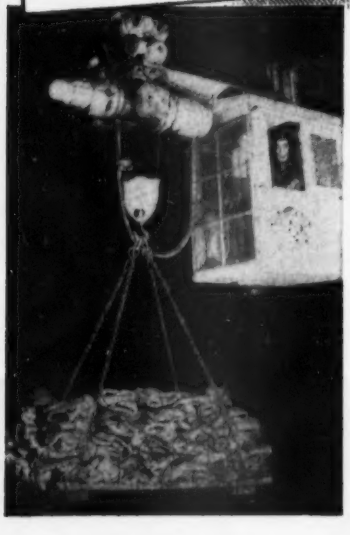
You can put your confidence in—

GENERAL ELECTRIC

SHEPARD NILES
Floor-Operated Hoist

Operator mainly occupied with other duties. Hoist used for fast, efficient handling of relatively short hauls.

WHICH HOIST is RIGHT FOR YOUR JOB?



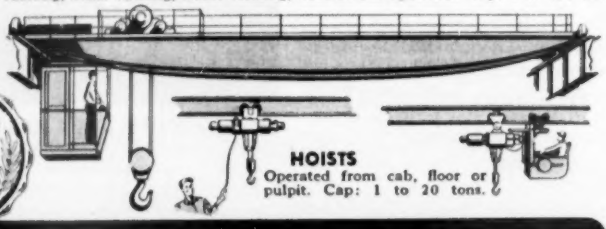
SHEPARD NILES
Cab-Operated Hoist

Operator in cab moves loads along at high speeds—occupies best vantage point for spotting or stacking materials.

Choosing the hoist that's right for your job calls for expert advice.

Let the Shepard Niles representative in your area guide you in your choice. He specializes in through-the-air handling—can help you select the hoist that best fits your job. Write Shepard Niles today for latest bulletins describing both types of hoists—and ask to have a representative stop by your office.

CRANES
Overhead: Top running, inner running, under running, floor or cab operated. Cap: 1 to 450 tons.



HOISTS
Operated from cab, floor or pulpit. Cap: 1 to 20 tons.

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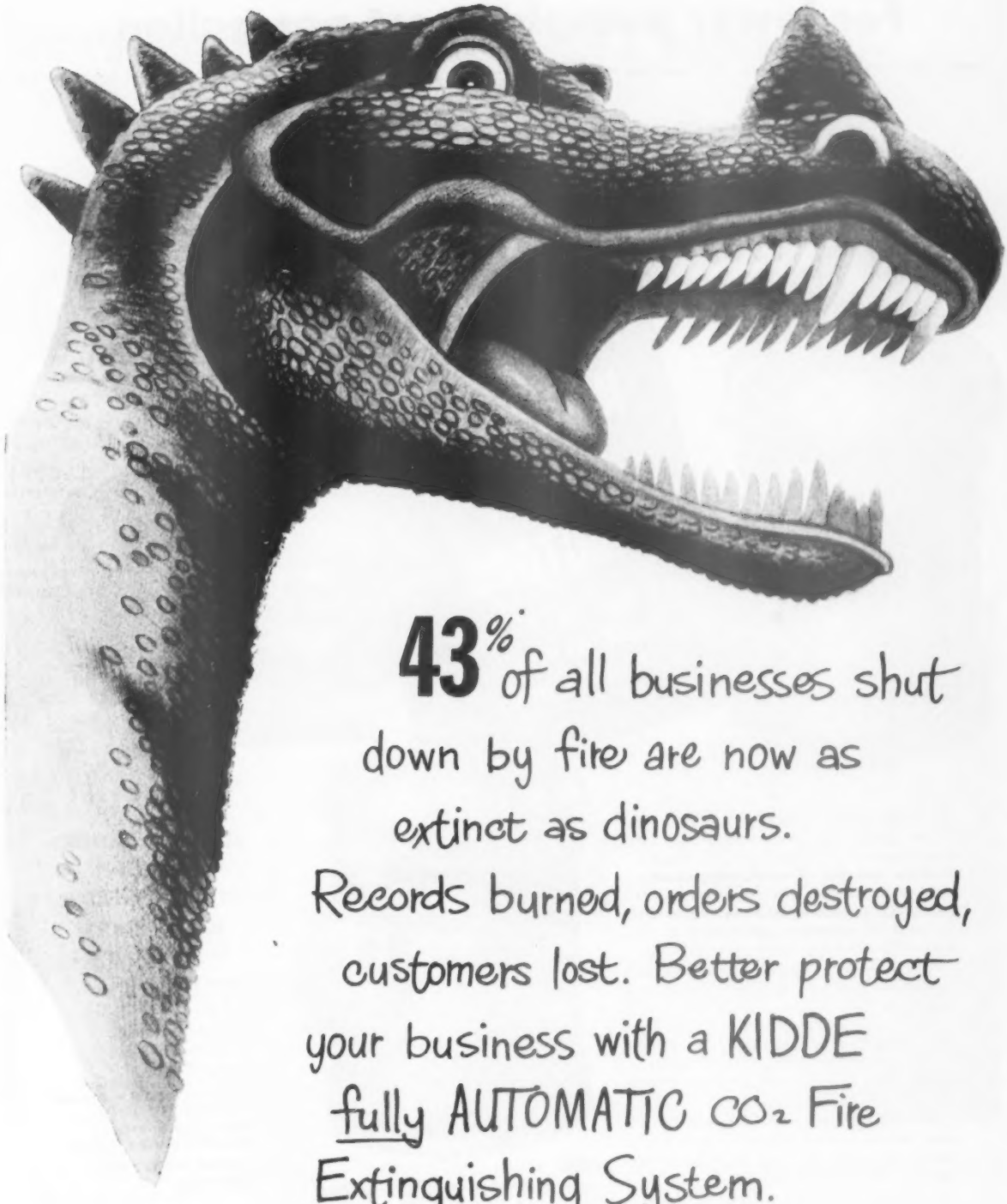
BEHIND THE BYLINE

Begins on page 336

ERNEST J. LAMBERTI (page 106), who began as a high school language teacher, writes about production control. Since his language teaching days, he's had some 10-years' experience in industry. Today he's doing industrial engineering for Federal Telephone & Radio, teaches management subjects part time.

W. H. PETERSON (page 262) tries to define why labor leaders act the way they do. He's worked in sales, public relations, and teaching. Present position: professor of economics at Polytechnic Institute of Brooklyn.

R. C. LAMBRECHT (page 148) who tells about his company's use of rust-preventive packaging, has been with General Motors' Electro-Motive Division for 10 years. He's manager of parts warehousing.



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Squirrel Cage—3-phase—Drip Proof—High Thrust—Standard Reverse Protection Clutch—3 to 75 hp. (larger sizes built to order)

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1 hp. to 75 hp. —all available from stock

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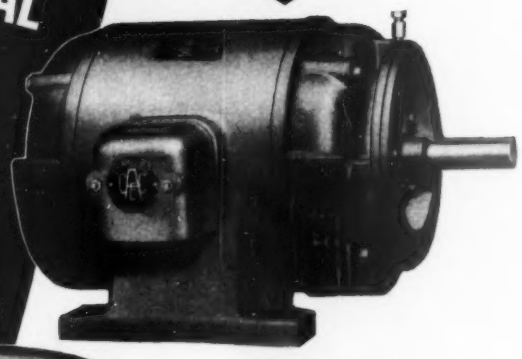

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Squirrel Cage—3-phase—Drip Proof—High Thrust. 900 to 3600 rpm—¾ to 25 hp. (larger sizes built to order)

For dependable operation at a lower cost per gallon, team your pumps with ACEC pump motors. Produced by the WORLD'S FOURTH LARGEST Electrical Manufacturer, ACEC pump motors offer the electrical and mechanical excellence that results from over 70 years of experience and research. Yet they're priced *below* most other motors.

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For top-level motor performance and utmost motor dependability *at lower prices,* contact our main office and we will have our nearest representative call you.

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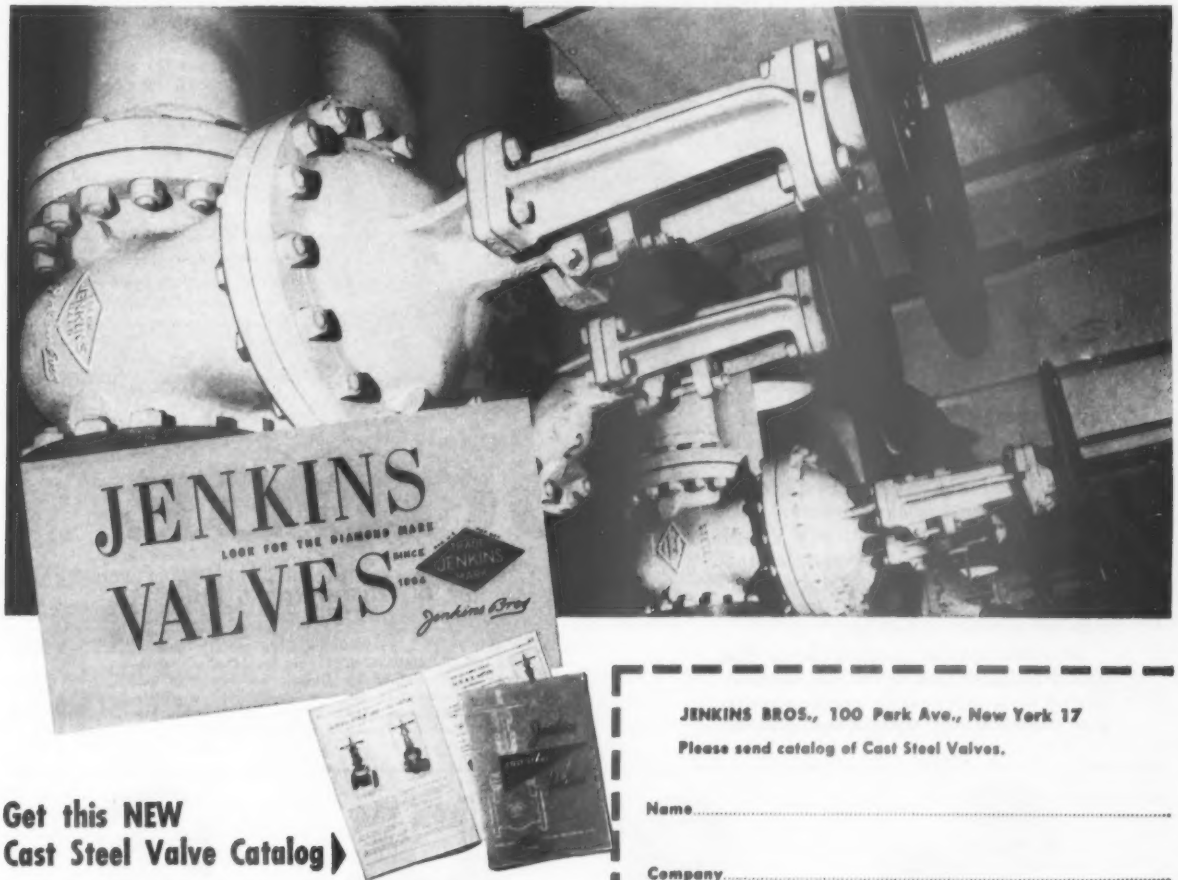

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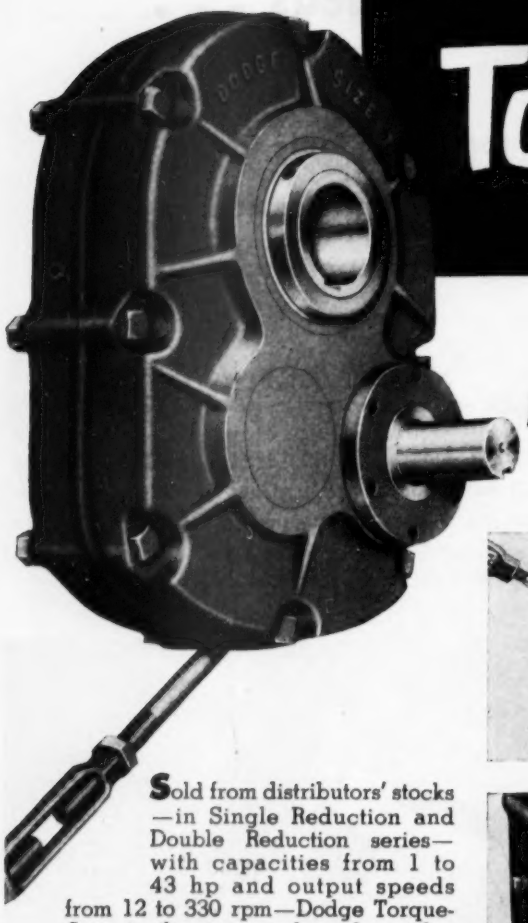

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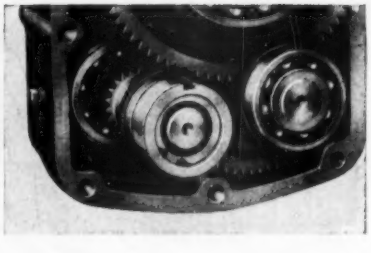
Provides instant, positive protection for driven machines, motors and reducer itself. Automatically (1) loosens the belts, (2) cuts off power, (3) gives a warning.



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Available from stock when required. Easily installed—sealed inside reducer housing. Simple, positive action prevents reversal.

Sold from distributors' stocks—in Single Reduction and Double Reduction series—with capacities from 1 to 43 hp and output speeds from 12 to 330 rpm—Dodge Torque-Arm is the new and modern idea in speed reducers.

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Unit is driven through any V-Belt Drive. Torque-Arm, fastened to any fixed object, anchors the reducer unit. Turnbuckle provides fast and accurate adjustment of belt tension.

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TAPER-LOCK SHEAVES, SEALED LIFE V-BELTS

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FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY, CHICAGO THRIFT-ETCHING CORPORATION, 1555 N. SHEFFIELD AVENUE, CHICAGO 22, ILLINOIS

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For further information, wire us collect: American Airlines, Inc., Cargo Sales Division, 100 Park Avenue, New York 17, N. Y.

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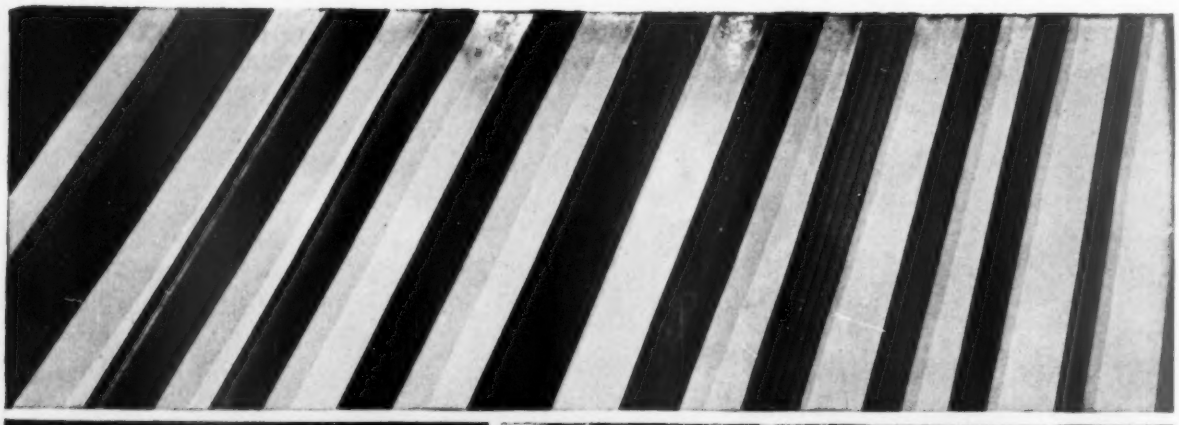

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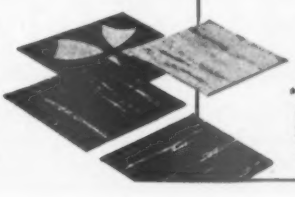
That's why it is your responsibility to select the right floor... the one floor that will give the best service at the least cost... whether it be the durable, easy-to-clean beauty required in public rooms or the colorful, resilient flooring needed in lounges, kitchens, lobbies.

By consulting your Kentile Flooring Contractor, you can be sure of getting just what you need for every flooring installation... and getting the most efficient service for the lowest possible cost.



Call the Kentile Flooring Contractor* for up-to-date information about these floors

- ✔ *KENTILE ASPHALT TILE*
- ✔ *KENRUBBER TILE FLOORS*
- ✔ *KENFLEX VINYL TILE*
- ✔ *KENCORK FLOORS & WALLS*
- ✔ *SPECIAL greaseproof KENTILE*

KENTILE INC.

***If you don't know the name of your Kentile Flooring Contractor look under FLOORS in your Classified Phone Directory or write Contract Dept., Kentile, Inc., 58 2nd Ave., Brooklyn 15, N. Y.**

MOBILIFT "stand-ups" Stand Out!

MOBILIFT *Stand-Up* type Fork Lift Trucks *Stand Out* for efficient, low cost materials handling in warehouses, terminals and plants because they get more work done faster.

Here's Why:

1. The operator gets on and off an ample size platform in a second or two. He works standing up — has maximum all around visibility.
2. MOBILIFTS are fast and agile. Compact design, short over-all length. 360° steering mechanism makes ZERO inner turning radius and 57" outer turning radius possible (2,000-lb. Model "E"). MOBILIFTS are long-time favorites for close, congested working areas.
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Let a MOBILIFT Sales Engineer show you why MOBILIFT Stand-Ups in your business will Stand Out!

Write or wire MOBILIFT for complete information today . . . No obligation of course.

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A socket—measuring 11″ in diameter, 8⅞″ in overall height, to drive 7⅝″ hex nuts.

An extension—measuring 3½″ in diameter, 30″ in overall length, with 2½″ male and female square drive.

This special Apex socket and extension is to be driven by a new power tool designed to develop 3,000 to 6,000 ft./lbs. of torque.

We're quite sure you can't use this particular Apex tool in your plant, but it's an interesting example of our ability to furnish an effective answer to just about any nutsetting problem.

AND THESE ARE APEX TOOLS . . .

Most likely, the answer to your nutsetting problems will be found among the more than 5,000 stock types and sizes of Apex nutsetting tools. If not, just send us a sketch or blueprint and we'll do our best to furnish a special answer . . . we'll quote promptly, without obligation.

CATALOG 29

122 pages of helpful information on Apex sockets, extensions, adapters, straight wrenches and universal sockets and wrenches. Write, on your company letterhead please, for your copy.

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about spray finishing and coating

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9 models
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Pump or spray "heavy" materials—like sound deadeners, buffing compounds, rust preventatives, gear lubricants, etc.—*directly from the original container* by using a Binks Material Handling Pump. You save up to 15% in handling time alone.

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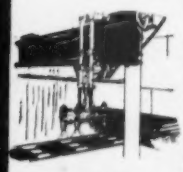

AUTOMATIC EQUIPMENT
lowers production costs
improves finish quality

Cut finishing costs automatically

On *flat* surfaces, use Binks Model 7R Spray Guns. Mechanical arms sweep the guns back and forth across products like wallboard, tile, glass, table tops, range parts, etc. On *round* or *multi-sided* products, use Binks Model 21 Guns for automatic finishing inside and/or outside. Ideal for such products as vehicle wheels, golf balls, appliances, etc.

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PAINT CIRCULATING SYSTEMS
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every time

Get identical finishes at each station

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AIR SUPPLY SYSTEMS
for filtered, heated air

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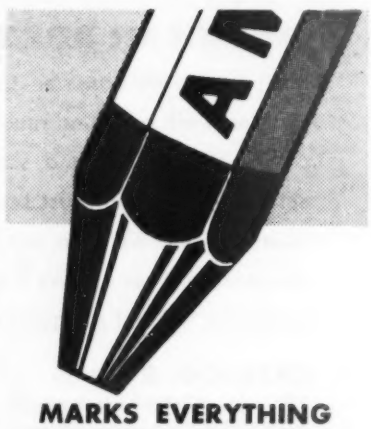

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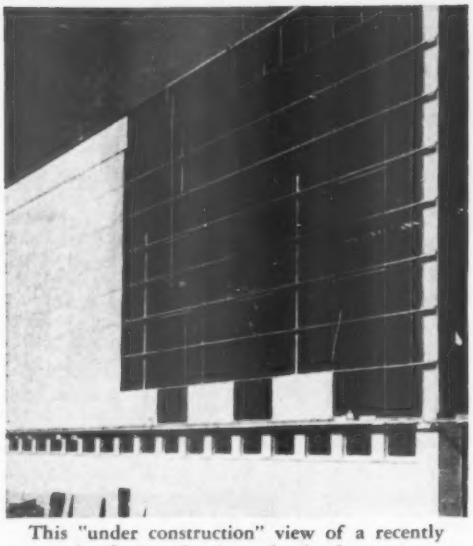
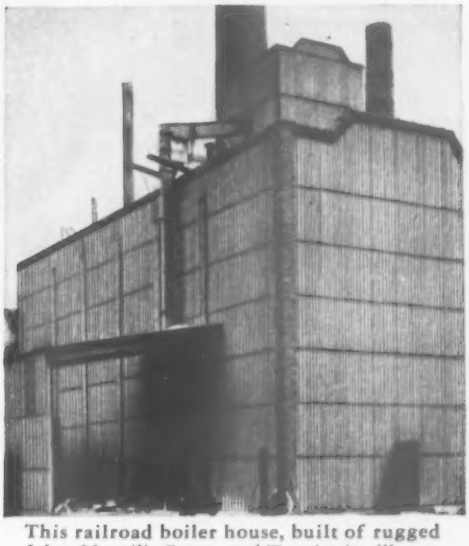


This "under construction" view of a recently completed aircraft plant clearly demonstrates how Johns-Manville Corrugated Transite goes up quickly and easily with a minimum of framing.

For Rugged Service



This railroad boiler house, built of rugged Johns-Manville Corrugated Transite, is still serviceable and presentable despite many years of heavy exposure to steam, smoke and soot.

You build economically and quickly with these versatile fireproof and weatherproof asbestos building sheets

In the past quarter century, Johns-Manville Corrugated Transite has proven an ideal material for roofs and for sidewalls of industrial, commercial, institutional and agricultural buildings. Made of asbestos and cement, the large sheets are easy to handle, go up quickly with a minimum of framing. Practically indestructible, Corrugated Transite is fireproof, rotproof, weatherproof, needs no paint or special treatment to preserve it, and can be salvaged and re-used if necessary.

Today, Corrugated Asbestos Transite is also used increasingly for smart interiors... the streamlined corrugations and attractive shadow lines that give it such unusual architectural appeal for exteriors offer unlimited interior design possibilities.

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Investigate J-M Corrugated Asbestos Transite and learn how you can build quickly and easily... have an attractive, long-lasting, trouble-free structure regardless of size or purpose. For complete details write Johns-Manville, Box 158, Dept. FM, New York 16, N. Y. In Canada write 199 Bay Street, Toronto, Ontario.

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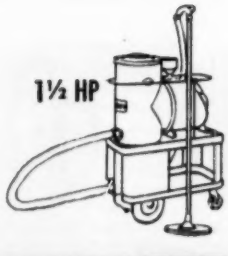

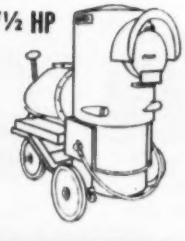

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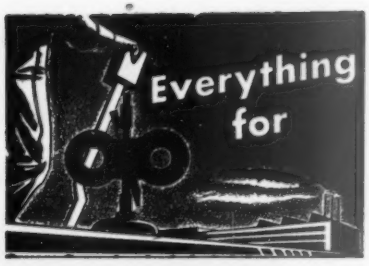

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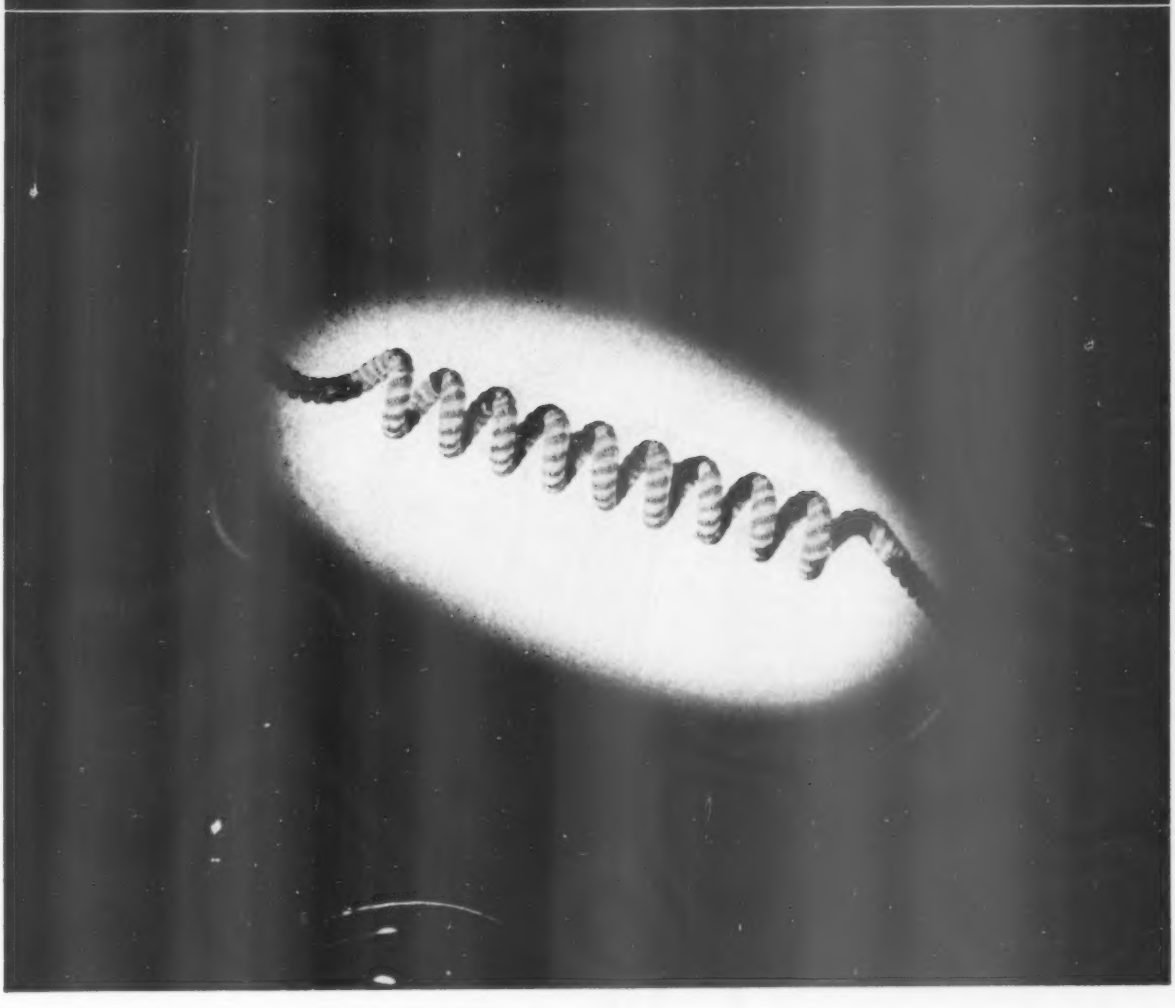

Extra twist squeezes more light from G-E slimline lamps

The electron flow that lights a fluorescent lamp is started by a special chemical mix held on tungsten filaments at each end of the lamp. How long the lamp lasts depends in part on how long the chemical clings to the filament. In most lamps, the filament is twisted into a double coil, to hold a quantity of the mix in a firm grip.

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One customer writes: "I always check over the size list of UNIVERSAL BRONZE Bars in the Johnson Catalog before ordering. No use machining away bronze when I can get the right machined diameter from stock. That saves me money two ways—I buy no more metal than I need—and I cut machine set-ups and machine time." Johnson UNIVERSAL BRONZE is completely machine finished inside diameter, outside diameter, and ends. There are 349 different combinations of sizes in cored bars, and 33 sizes of solid bars.

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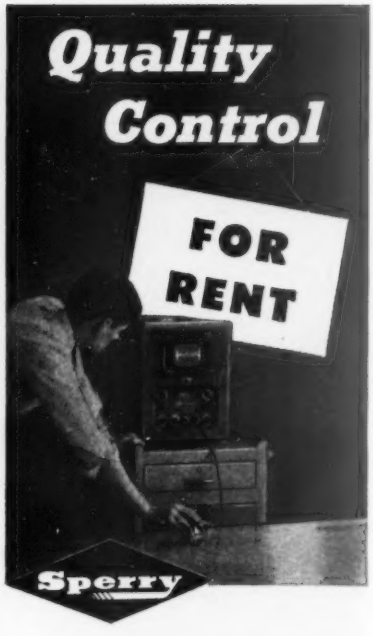

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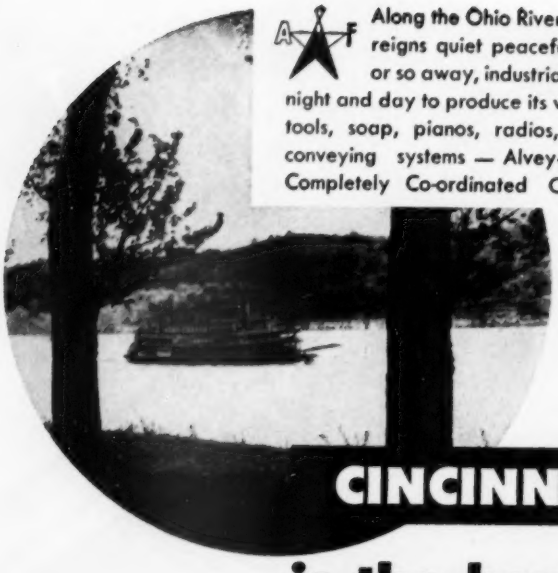

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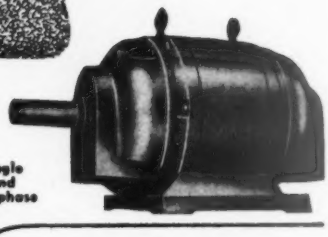

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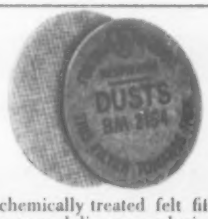

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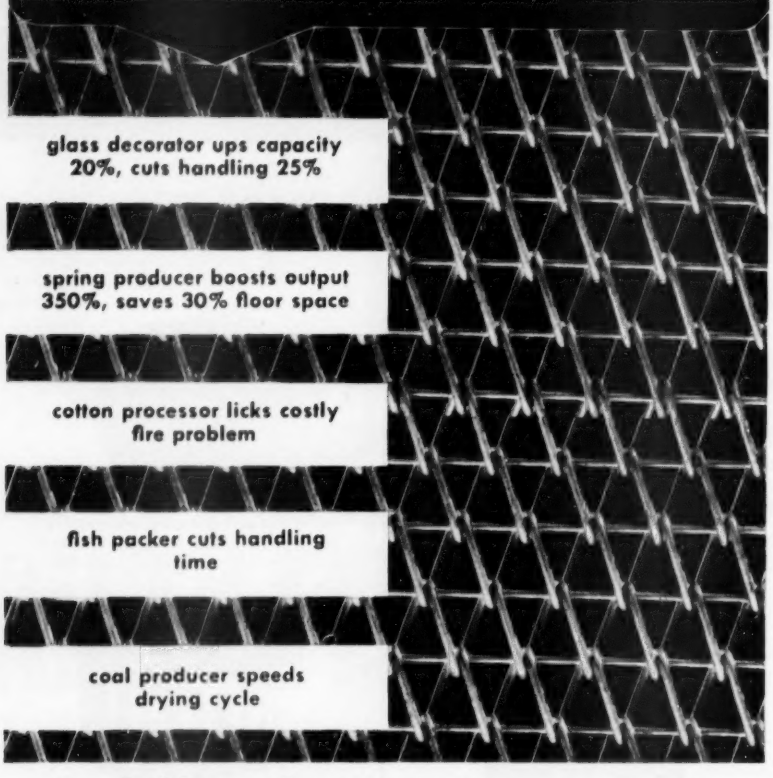
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They can be used at temperatures ranging from sub-freezing for food packers, to as high as 2100° F. for heat treating. They can be used in corrosive solutions such as pickling acids or in ordinary water if your product must be washed during processing. Open mesh of the belt allows free circulation of process atmospheres, free drainage of process solutions. All-metal construction means long life and low maintenance. They're available in any metal or alloy, mesh or weave, length or width.

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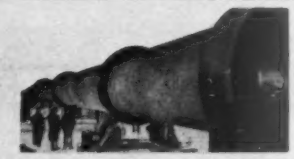

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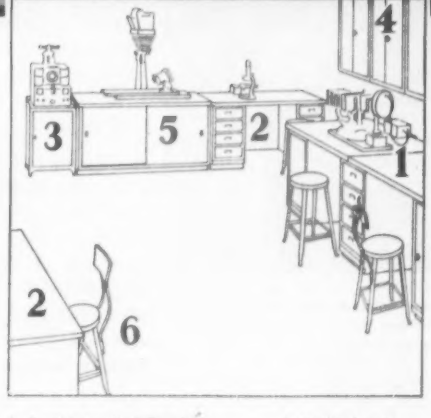

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Two belt conveyors handle in-process forms; accumulation conveyors (diagonal spur sections) hold orders for release to shipping; main line roller conveyor takes cartons to stapling operation and on to shipping room.

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Over a third-mile of belt and roller conveyors replaces skid system . . . save 2,000 square feet of floor space . . . 30% in man hours!

After stapling, cartons are elevated by Beltevator to the gravity roller conveyor which carries them to shipping room.

Typical of "pay-for-themselves" records set by BUSCHMAN Conveyor installations is this one in the Chicago plant of UARCO Inc., noted business form manufacturer.

A main powered roller conveyor skirts the printing area, two belt conveyors and forty-six accumulation gravity conveyors achieve a 30% cut in time over the former skid load system.

From long experience, BUSCHMAN Engineers can suggest time, money and space saving equipment for the handling of your materials from receiving through process, assembly and finishing to storage or shipping. BUSCHMAN Conveyor installations are complete to meet your specific needs—dictated by your products, process and space available.

Write for Bulletin No. 60

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Use of G-E Super Coronol* Cable helps solve difficult cable layout problem

Installation speed important feature of G-E interlocked armor cable system

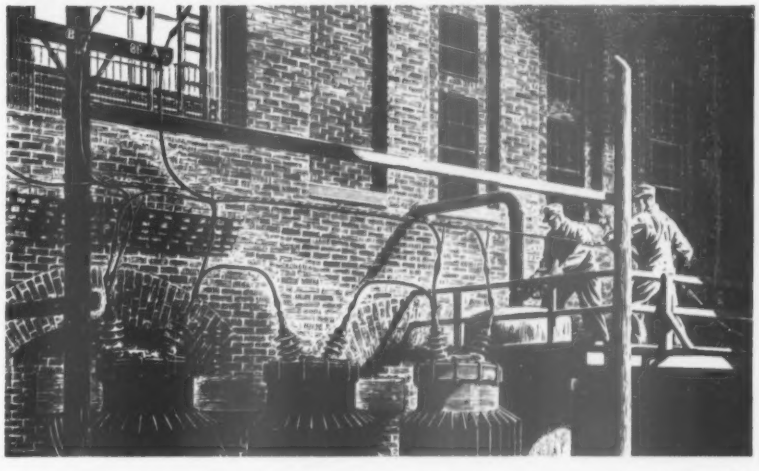
Here's a thought for rewiring plants in a hurry, keeping costs in line, and possibly maintaining production at the same time: Investigate the G-E V-c interlocked armor cable system.

The ease and speed with which this interlocked armor cable system can be installed lowers costs. The cable can be laid quickly—indoors or outdoors—in long lengths, around corners, on low-cost aluminum racks. Engineering time is cut. Threading or bending of conduit is eliminated. Splices are of a simple, mechanical type. Many plants have saved months, not days, because of these features.

Permanent

To our knowledge, no installation of interlocked armor cable has ever suffered mechanical damage sufficient to cause electrical failure. The cable is versatile as well as permanent and makes a neat, clean-looking installation. A booklet that describes the G-E No. 1799 varnished-cambric-insulated interlocked armor cable system is available.

Flexibility of interlocked armor cable is demonstrated here—corners and projections present no installation problems.



The cable layout for these transformer leads was suggested by a G-E wire and cable specialist. The layout resulted in an important improvement in safety and appearance.

Ionization testing standard G-E procedure

In order to make certain that the cable has been properly constructed, G. E. makes an ionization test of every foot of Super Coronol cable rated over 5 kv. This is standard practice. Even continuous lengths as long as 3100 feet have been tested on special equipment made for this purpose. It is tests like these that help to insure the dependability of all G-E cable. If you wish, a G-E wire and cable specialist can furnish additional information about ionization testing.

USEFUL BOOKLET

In one handy booklet you get informative data on G-E Versatol* Geoprene cable's installation and maintenance economies. The booklet, Pub. No. 19-390, can help you determine applications for these dependable, general purpose cables. Write for your free copy today.

*Registered Trade-mark General Electric Company

On any cable problem you can get prompt, expert help from your G-E wire and cable specialist. Here is an example. In the Omaha Public Power District a local brewery was confronted by this hazard—bare wire was used for the drops from an overhead 13.2-kv line to transformers. Liquid waste from vats kept the air moist. And with an elevated platform nearby, it was possible for men working on a condenser to get too close to the high voltage for safety.

In looking for the answer, the Power District asked the G-E Construction Materials Omaha office for a cable layout. The G-E wire and cable specialist submitted one—based on the use of 15-kv Super Coronol Geoprene cable. This cable, which is shielded, not only eliminated the danger from bare wires, but improved appearance as well. Because the cable was preformed in the utility's service shop, and terminations made in advance, installation was made with a minimum of shutdown time.

The next time you have a question on cable or want any of the booklets mentioned in this advertisement, call a G-E wire and cable specialist for expert help. You can reach him at the nearest G-E Construction Materials district office. Or, write Section W68-334, Construction Materials Division, General Electric Company, Bridgeport 2, Conn.

You can put your confidence in—

1878 75 1953 YEARS OF ELECTRICAL PROGRESS

GENERAL ELECTRIC

Guards Property 24 Hours a Day in All Weather, Year after Year!

that's why you should install

Anchor Fence

YOU get three immediate and important benefits as soon as you have Anchor Fence erected around your plant. First of all, your Anchor Fence will keep trespassers, agitators, and vandals *outside* your grounds.

Equally important, your Anchor Fence will protect your materials and various supplies stored in the open.

Finally, your Anchor Fence will help you control plant and vehicular traffic with maximum efficiency and economy.

But, be sure you get genuine Anchor Fence. *There are imitators!* So, look for the orange-and-black identification plate that *only* Anchor Fence may carry. That plate is your guarantee of the finest in industrial fencing.

* * *

FOR ADDITIONAL INFORMATION send for Anchor's fact-packed Industrial Fence Catalog. Or ask to have one of our experienced engineers submit recommendations . . . without obligation, of course. Write: ANCHOR POST PRODUCTS, INC., 6620 Eastern Ave., Baltimore 24, Maryland.

Anchor Fence

Division of Anchor Post Products, Inc.

958 Concerns and Communities . . . big and little . . . have discovered*

HOW TO CUT ONE ESSENTIAL ITEM OF DAILY MAINTENANCE EXPENSE 75%

*WILSHIRE Power Sweepers

The man with a broom is never through! As fast as he reaches one end of the plant or the street, the other end is cluttered up again. He keeps sweeping . . . and you keep paying . . . day after day . . . year after year. A needless waste of time and money!

1 man with 1 WILSHIRE Power Sweeper sweeps 6 to 38 times faster than 1 man with 1 broom. That means you keep factory and warehouse floors, yards, parking areas, streets, alleys . . . everywhere a man can handle a broom . . . cleaner, safer and more sanitary. And it costs you *less* than you are now paying to do it the inefficient, hard way. In fact, your WILSHIRE Sweeper will pay for itself in just a few months.

Your nearest WILSHIRE Dealer will be glad to show you the names of the many concerns and communities now cutting sweeping costs with WILSHIRE Power Sweepers. And he'll be glad to prove every statement he makes with a free demonstration. Just mail the coupon!

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POWER SWEEPERS
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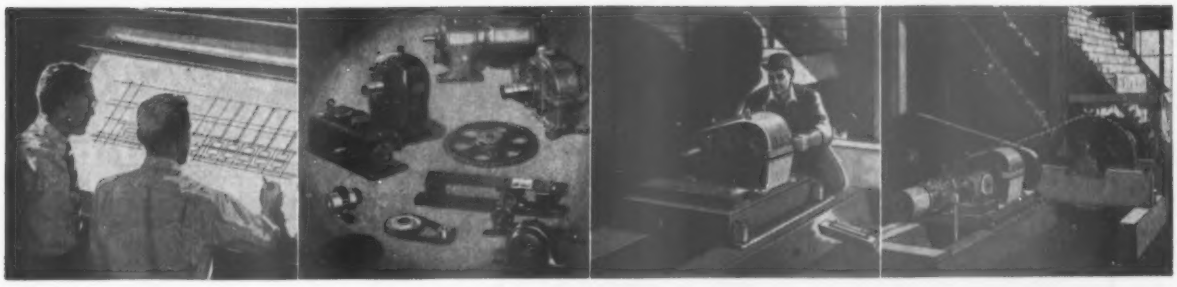
Wilshire Power Sweeper Co.
525 W. Chevy Chase Dr.
Glendale 4, California
Please send me your illustrated brochure with data on sweeping.

Name_____
Company_____
Address_____
City_____ Zone____ State_____

IN CANADA · PLANT MAINTENANCE EQUIPMENT CO. · VANCOUVER & TORONTO



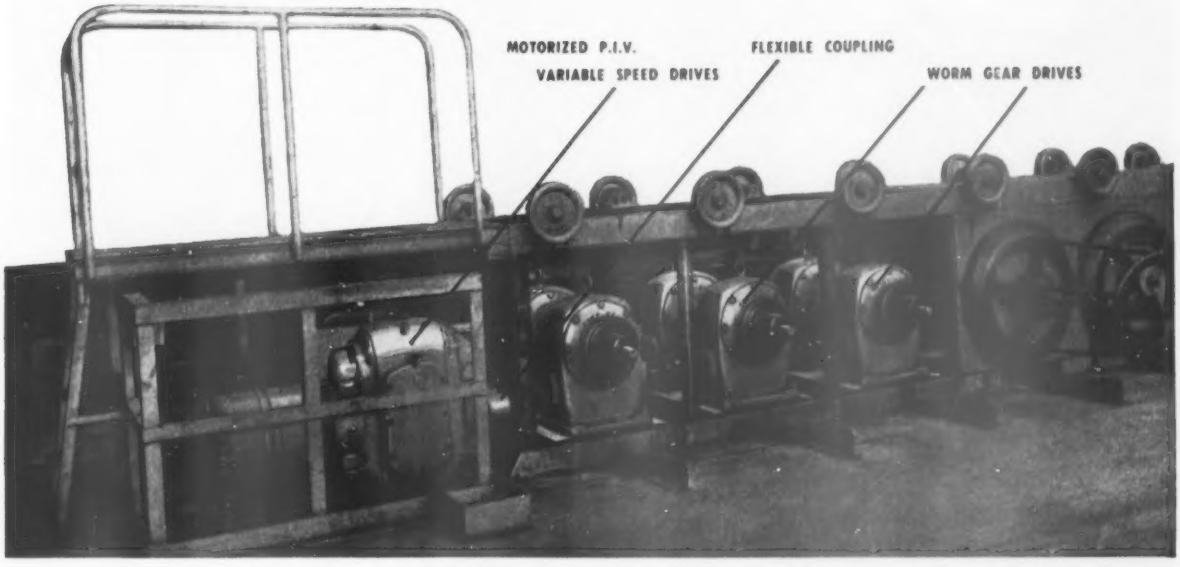
OVERALL ENGINEERING. Vast experience of design and field engineering staff integrates all factors, assures expert planning.

ALL COMPONENTS. Link-Belt builds a complete line of power transmission machinery, provides components of top efficiency.

PRE-ASSEMBLY. Sprockets can be mounted in our shops—bearings fully protected. No need to get drawings from other sources.

SINGLE RESPONSIBILITY. When you rely on Link-Belt as a source, we accept responsibility for overall operation.

For top overall efficiency, let LINK-BELT integrate your power transmission



Accurate travel control is assured by Link-Belt's overall integration of this wire annealing furnace drive.

Read why it pays to make LINK-BELT your power transmission headquarters

THE more complex your power transmission requirements — the greater service Link-Belt can render you. Here, at "power transmission headquarters," we're in a unique position to give your application the overall integration so necessary for top efficiency.

From original planning to final responsibility for satisfactory performance, Link-Belt carries through every detail. As builders of industry's most complete line of power transmission equipment, we offer helical, herringbone and worm gear drives . . . variable speed, fluid and chain drives . . . bearings, clutches and couplings, and other components.

Selecting the right combination of these quality components is merely the first step. Link-Belt also engineers the controls . . . pre-assembles elements for extra protection . . . supervises the installation.

To put Link-Belt's vast facilities to work for you, call your nearby Link-Belt office. One of our engineers will call at your convenience — help you get the best in power transmission.

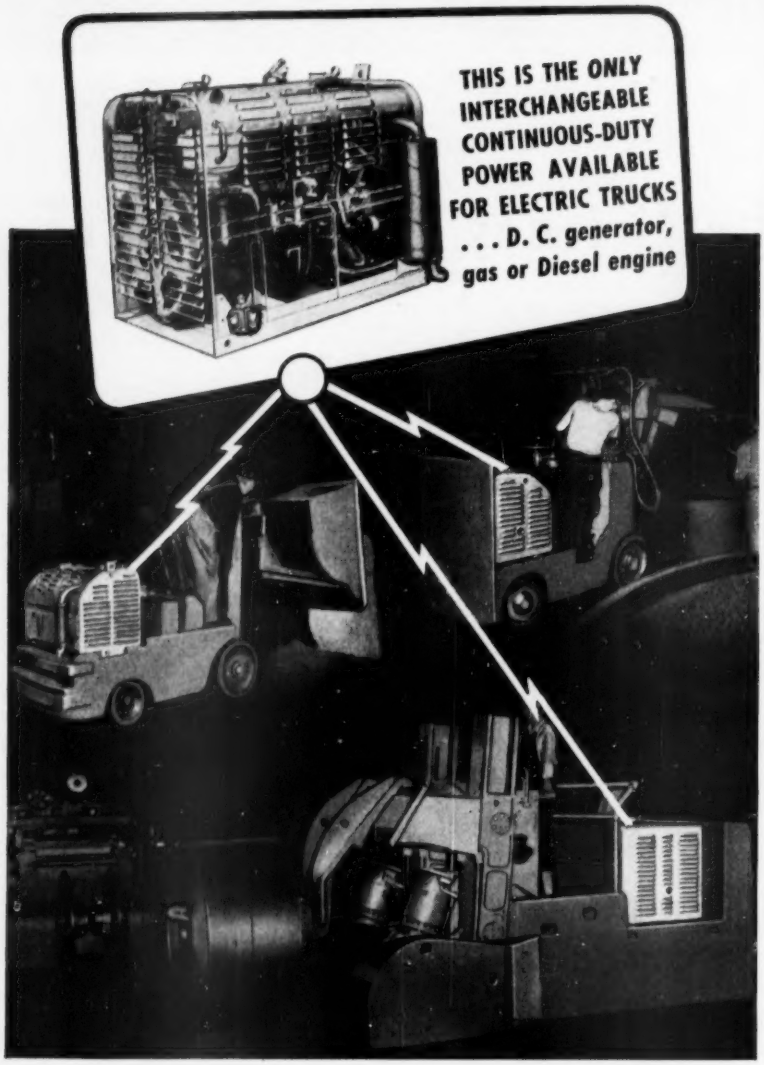
19,130

LINK-BELT

POWER TRANSMISSION EQUIPMENT

LINK-BELT COMPANY: Plants: Chicago, Indianapolis, Philadelphia, Colmar, Pa., Atlanta, Houston, Minneapolis, San Francisco, Los Angeles, Seattle, Toronto, Springs (South Africa), Sydney (Australia). Sales Offices in Principal Cities.

Ready-Power Adds 'GUTS' to Electric Truck Performance


THIS IS THE ONLY INTERCHANGEABLE CONTINUOUS-DUTY POWER AVAILABLE FOR ELECTRIC TRUCKS . . . D. C. generator, gas or Diesel engine

Only Ready-Power Drive gives electric trucks the stamina that means *full power all the time!* With no limit to hours of service, Ready-Power-equipped trucks handle the toughest jobs at lowest costs per ton-mile. Gas-electric and Diesel-electric models are available for ALL sizes of electric trucks.

CONTINUOUS-DUTY POWER UNITS

Remember...Your Truck Is No Better Than Its Power!

The READY-POWER Co.

3820 Grand River Ave., Detroit 8, Michigan

Manufacturers of Gas and Diesel Engine-Driven Generators and Air Conditioning Units; Gas and Diesel-Electric Power Units for Industrial Trucks

EMERGENCY

INTERCOM SERVICE INDEPENDENT OF POWER SERVICE

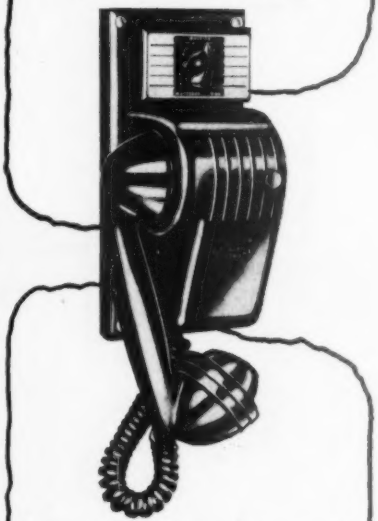
Quickly... easily... install

WHEELER

SOUND POWERED

Electric

TELEPHONES



Power or telephone failure could shut down your intercommunications when MOST needed. But not if you have a Wheeler System, which is INDEPENDENT of outside power, yet requires NO BATTERIES and is ALWAYS ready for use. Easily installed...safe...not subject to deterioration. Handsets, Pair Phones, complete intercom systems. Write us for details.

the **WHEELER**

INSULATED WIRE CO., Inc.

DIVISION OF THE SPERRY CORP.

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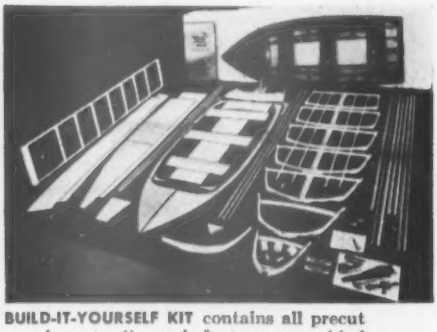
WATERBURY, CONNECTICUT

26WH52C

Acme Steel Strapping Insures S.A. *(Safe Arrival)*

Boat kits come in cartons secured by Acme Steel Strapping

BOAT IN A BOX. Carton in foreground contains all small parts for complete Chris-Craft. Now it's being secured for shipment by Acme Steel Strapping.



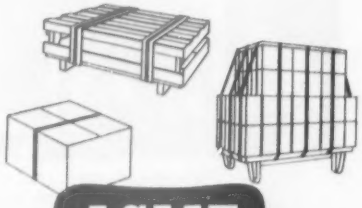
BUILD-IT-YOURSELF KIT contains all precut wood parts, jig and factory-assembled frames for a Chris-Craft De Luxe Runabout.

STRAPPING BOATS ON A TRUCK. When a truckload of boat kits leaves the Chris-Craft plant, Acme Steel Strapping both secures individual kits, and anchors whole load to truck for a safe journey.

The pictures tell the story. That's the way that Acme Steel Strapping helps a leading manufacturer solve a tough packing problem and insure Safe Arrival of his goods.

Most likely Acme Steel Strapping can serve you, too. It guards against damage to goods in transit. It saves on labor costs because it's so quick and easy to apply. It takes the place of bulkier, costlier packing materials.

If you have a problem like this, Acme Steel Strapping or Acme Steel Stitching Wire methods may provide just the solution you need. Write Acme Steel Products Division, Dept. FMM33.



ACME STEEL

Acme Steel Products Division **ACME STEEL COMPANY** 2849 Archer Avenue, Chicago 8, Ill.

Start With Any One of These

FOUR WAYS To Cut Your Handling Costs

1 WITH ROLLER OR BELT CONVEYORS

— Wherever packages, parts, or units have to be handled — do it faster, better, cheaper, with Standard roller or belt conveyors, power or gravity. Standard also builds slat, chain, wheel, or pushbar conveyors to fit your needs.

2 with a HANDIBELT

— a small, light, compact, easily portable and maneuverable conveyor unit that stacks, loads, unloads cases, cartons, packages up to 135 lbs. in weight. Can be used inclined, declined or horizontal. Electric motor operated.

3 with SPIRAL CHUTES

— effective time, work and money savers lowering pieces, parts, packages floor to floor. Scientifically designed and properly pitched—available in many types and sizes. Cost nothing to operate.

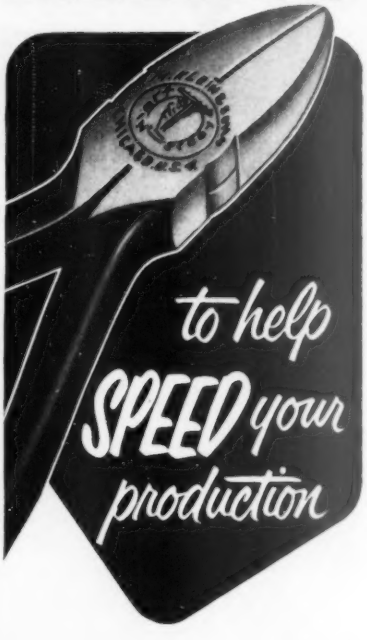
4 with PNEUMATIC TUBE SYSTEMS

— provide swift, sure, safe transportation of messages, documents, blueprints, samples, small parts, money; cylindrical or oval tubes 1½ inch upward with dispatching and receiving terminals for complete systems to meet your needs. Write for special bulletin SPT.

Write for standard's general Catalog No. FM-33. Tell us what you want to handle or name equipment on which you want more information.

STANDARD CONVEYOR COMPANY
North St. Paul 9, Minn.
Sales and Service in Principal Cities

KLEINS



The job goes quicker —and with less effort when the pliers are Kleins. Workers appreciate the hand fit of the handle and proper balance—the keen knives that stay sharp even after long service. In the complete Klein line of pliers, you'll find a type exactly suited to *your* needs.

ASK YOUR SUPPLIER

Foreign Distributor: International Standard Electric Corp., New York

Write for your free copy of the Klein Pocket Tool Guide today!

"Since 1857"

Mathias KLEIN & Sons
Established 1857 — Chicago, Ill., U.S.A.
3200 BELMONT AVE. CHICAGO

IF YOUR ROOF LOOKS LIKE THIS,

then you're money ahead to cap it with Fiberglas Corotop. New Owens-Corning Fiberglas process is ideal for alligatored or blistered roofs. Once roof is prepared and patched, Corotop gives it a long-lasting cover in three steps. (See below.)

THIRD AND FINAL STEP IN FIBERGLAS COROTOP WILL MAKE YOUR ROOF LOOK LIKE THIS.

This top-coating assures tough, long-lasting resistance to heat, cold, moisture.

New low-cost maintenance for old asphalt roofs

Fiberglas Corotop* introduces new economy and long life to roof maintenance. It goes down fast, saves time and money. And it's made from specially processed emulsified asphalts reinforced with flexible, non-rotting mat of fibers of glass. Corotop results in a tough, ever-plastic, long-lasting surface made for heavy duty.

Fiberglas Corotop seals old roofs monolithically from coping to coping, edge to edge in one application. Eliminates stopgap puttering, saves maintenance dollars. Will not alligator or blister. Get all the facts now!

FIRST STEP consists of spraying strip of Corotop Liquid Asphalt into which is imbedded or unrolled a layer of Fiberglas Corotop Roofing Mat. Open-mesh character of mat allows asphalt to penetrate through and "weld" with second coat.

SECOND STEP seals first two layers, integrates reinforcement mat with asphalt. Roof is then left to dry for 12 hours, or over night. Corotop emulsion can be applied by brush or spray.

SEND FOR THIS SAMPLE FOLDER which contains mat and sample of pliable, tough Corotop and complete details of process. No obligation.

OWENS-CORNING FIBERGLAS COROTOP

Sold through Fiberglas-approved roofers

*Fiberglas (Reg. U. S. Pat. Off.) and Corotop are trade-marks of Owens-Corning Fiberglas Corporation.

OWENS-CORNING FIBERGLAS CORP.
Dept. 85-C, Toledo 1, Ohio

Please send me the Corotop sample folder and complete data of the Corotop process. No obligation.

Name _____

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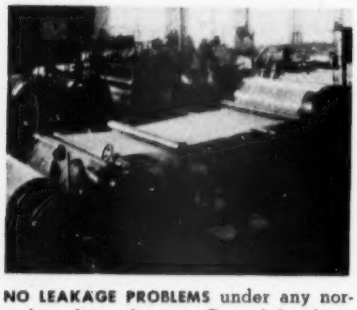
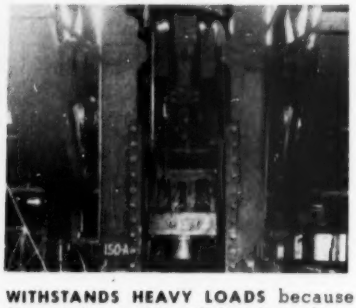
City _____ State _____

Houghton Cosmolube
Multi-Purpose Grease
Simplifies Lubrication

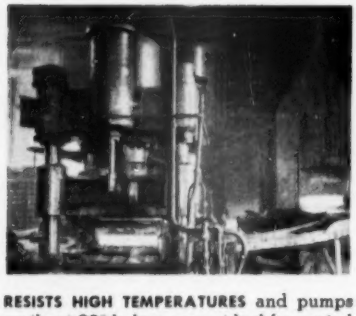
COSMOLUBE *meets bearing lubrication needs throughout your plant—perfect for hot, cold and wet spots—just one grease to buy, store and apply! No chance of misapplication!*



NO LEAKAGE PROBLEMS under any normal conditions because Cosmolube clings tenaciously to all metal surfaces. This adhesiveness provides better protection to moving parts.



WITHSTANDS HEAVY LOADS because Cosmolube is cold milled and stands up under extreme working stress. Its exceptional oxidation resistance also prevents deterioration in storage.



RESISTS HIGH TEMPERATURES and pumps easily at 20° below zero—ideal for varied plant applications because Cosmolube remains stable under a wide range of temperature conditions.

HIGH MOISTURE RESISTANCE is assured because Cosmolube is insoluble in hot or cold water. It provides utmost lubrication even in machinery that gets drenched with water daily.

GET LATEST "COSMOLUBE" BULLETIN from the Houghton Man . . . or write to E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.

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Ready to give you on-the-job service . . .

Rout the dollar losses
hiding behind poor cost control

Try the new conversion-cost method of finding and plugging leaks

There is only one realistic way to control costs and thus keep profits from sifting away, says this famous industrial engineer. He brings a thoroughly unique approach to the problem of cost, pricing, and profit in manufacturing. Since manufacturing is conversion of the material to the product, that is the cost that must be reckoned—the total conversion cost. In this book he fully explains the approach and describes the methods through which to plug cost leaks . . . know how to price each line . . . and develop effective methods of cutting costs and increasing production.

Just Published!

HOW TO CONTROL PRODUCTION COSTS

By Phil Carroll

Author of *Timestudy for Cost Control*
Timestudy Fundamentals for Foremen
How to Chart Timestudy Data

264 pages, 6 x 9, 76 illustrations, $5.00

This practical book is written for immediate in-the-plant use. Besides thoroughly explaining the total-conversion-cost method of control, it gives you every tool for putting that method to work immediately.

You start by throwing out old and unreliable systems—budgets that are unrealistic or overhead ratios that are more a drag than a guide.

Then you are shown how to set up the new conversion-cost system, by first setting up a realistic overhead—based on standard time—and finding standard material costs. Thus you can plot your expenses, find your variances, and price your products "right."

The action you must take to make this new system really effective is clearly outlined for you in the book. You'll see here how to make accurate sales forecasts . . . control production within accepted variances . . . get engineers to specify . . . set up effective employee incentives . . . get clear, prompt reports.

Packed with techniques to help you set up the new method:

How to set up **charts for plotting a curve of expenses.** There's only one sound way to do this, says this engineer-manager, and he tells you how to draw the curve, how to adjust the curve, how to read the curve.

How to find your **standard material costs,** and how to figure out the variances from these.

How to find the **leaks in cost control**—the variances—and how to call attention to them and act on them.

How to tell whether a **"special line"** is making money or costing money. Shows you hidden costs in a special operation.

How to use a basic rule to determine **how much stock** you should carry.

How to know **which kind of employee incentives**—profit-sharing, bonuses, individual incentives—really work in getting out more production.

——SEE THE BOOK TEN DAYS FREE——

McGraw-Hill Book Co., 330 W. 42 St., NYC 36

Send me Carroll's **HOW TO CONTROL PRODUCTION COSTS** for ten days' examination on approval. At the end of ten days I will remit $5.00, plus few cents for delivery, or return book postpaid. (We pay for delivery if you remit with this coupon; same return privilege.)

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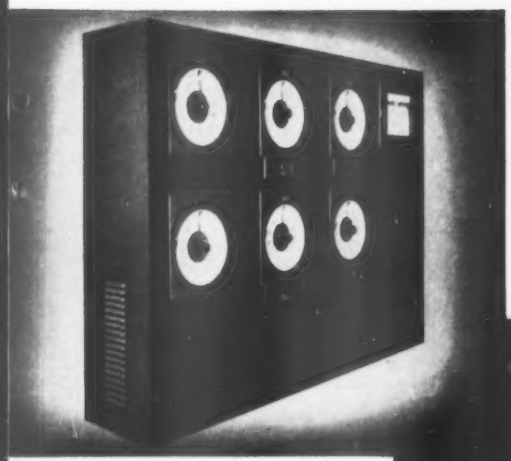
This offer applies to U.S. only.

Job-engineered instrumentation by Honeywell assures performance ... saves time



APPLICATION ENGINEERING
starts with cooperative discussion between customer and Honeywell engineering representatives . . . follows through to design and assembly of complete control systems.

THERE'S more to instrumentation than instruments. Any control system, to do its job right, has to be designed for the methods, equipment, materials and of the process with which it works.

Here is where Honeywell Application Engineering steps in. First, a Honeywell engineering representative discusses process details with your engineers, production men and instrument technicians. Then he refers the problem to staff application engineers . . . each of whom is trained in the methods and control techniques for a specific industry.

These men work out details of what instrument to use for each measurement or control function . . . what type of primary element . . . what control system . . . what size and style of valve. Then they combine all these components into a complete system that is arranged for greatest production efficiency, convenience, and ease of service.

The new result to you is two-fold. First, this service saves you many valuable man-hours by supplementing the work of your own engineering staff. Second, you're assured of a control system that will give you the best in performance, not only of the Honeywell instruments, but also of the process which they serve.

Application engineering is one of the most important plus values you get from Honeywell instrumentation. Ask your local representative to discuss how it can go to work in your plant modernization or expansion . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4461 Wayne Avenue, Philadelphia 44, Pa.

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS
First in Controls

This special fiber Pittsburgh Brush has removed excess solder from seam of can shown emerging from cleaning machine—at the American Can Company.

"Wouldn't be without them!"

say the men who use . . .

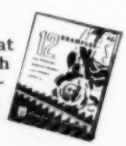
Power-driven Pittsburgh Brushes for longer life, better work!

Last longer, much safer—Cloth brushes formerly used at the American Can Co., Jersey City, to wipe excess solder from can seams lasted less than an hour, occasionally caught fire. Switching to special fiber Pittsburgh Brushes, American Can now gets better than 15 hours life per brush and the fire hazard has been eliminated. Supervisory personnel reports: "We wouldn't be without them!"

Last longer, do better job—In producing wall and ceiling panels, at the Barclay Manufacturing Co., New York City, dust caused by routing "mortar lines" settles on the panels, must be completely removed before panels can be bake-finished. Brushes originally used had a short life span, wore unevenly, and did so poor a job that many baked panels had to be completely refinished to pass inspection. Since even a "fairly good" brush would not do, Barclay searched for the "perfect" brush—and chose Pittsburgh! Result: Better work, and costly refinishing eliminated.

Last longer, better constructed—The Windalume Corporation, Kenvil, N. J., manufacturers of aluminum windows, uses Pittsburgh wire brushes to remove burrs caused by milling. The wire bristles on the brushes used formerly broke off easily. Windalume replaced them with Pittsburgh Brushes because they are better constructed—and Pittsburgh Brushes last longer!

WRITE TODAY FOR FREE BOOKLET!



Write today for a free copy of our booklet that shows, through actual case histories, how Pittsburgh can help cut *your* brushing costs. Address: PITTSBURGH PLATE GLASS COMPANY, *Brush Div.*, Dept. W-3, 3221 Frederick Ave., Baltimore 29, Md.

PITTSBURGH

Power Driven

BRUSHES

BRUSHES • PAINTS • GLASS • CHEMICALS • PLASTICS • FIBER GLASS

PITTSBURGH PLATE GLASS COMPANY

6 Essential Facts

for a company with a Water Problem...

1. Costs Far Less to Install!
A Ranney Water Collector will add millions of gallons to your daily water supply—at a fraction of the cost of conventional systems!

2. Less Expensive to Operate!
A Ranney Water Collector is far less expensive to operate—uses fewer pumps, fewer personnel, less power, and usually requires no treatment facilities.

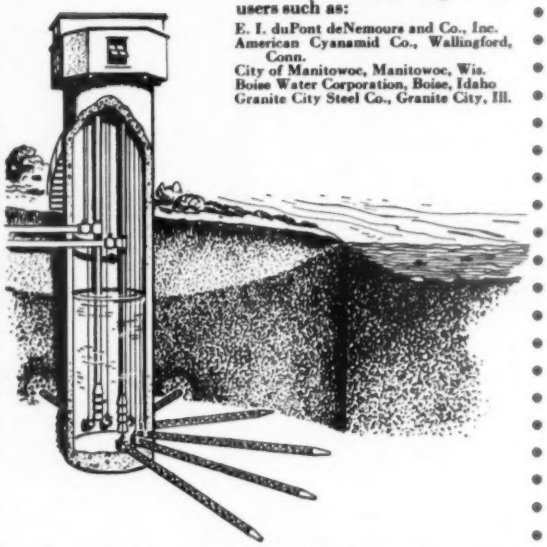
3. Maintenance Requirements Practically Nil!
A Ranney Water Collector requires little or no maintenance. The rate of flow through the Ranney Collector's apertures eliminates clogging and silting. No filter plant maintenance.

4. More Water per Unit!
A single Ranney Water Collector has produced more clear, cool water than ten conventional vertical wells.

5. Far Longer Life Cuts Depreciation Costs!
The longer life of a Ranney Water Collector lowers financing and depreciation rates appreciably.

6. Ask These Satisfied Users
Ranney Water Collectors are currently rendering excellent service to scores of large water users such as:

E. I. duPont deNemours and Co., Inc.
American Cyanamid Co., Wallingford, Conn.
City of Manitowoc, Manitowoc, Wis.
Boise Water Corporation, Boise, Idaho
Granite City Steel Co., Granite City, Ill.



An inexpensive Ranney survey will determine how the Ranney Method can work for you.

If you need water, write us for complete information on how a Ranney Water Collector will solve your problem.

Ranney Method Water Supplies, Inc.

HYDROLOGISTS AND WATER SUPPLY CONTRACTORS

Executive and Engineering Offices
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Money Back Guarantee!

Sylvania Fluorescent Lamps must outperform all others or your money back!

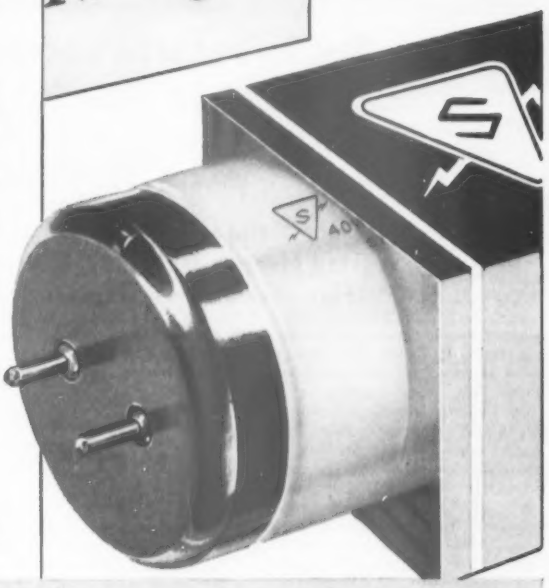
Try 24 Sylvania Fluorescent Lamps of any popular type. If they don't give more light and maintain color and brightness for a longer time than any other brand, send them back with your signed Certificate of Assurance and your money will be refunded.

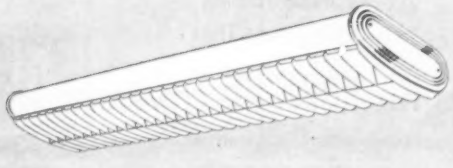
Remember, Sylvania is a pioneer in fluorescent lighting! Sylvania's modern developments in fluorescent powders and coil coatings now assure the best light and more of it for the longest time. For the full story of "Fluorescent at its Finest" . . . and why we can guarantee it . . . write to Sylvania NOW!

SYLVANIA

Sylvania Electric Products Inc. — *1740 Broadway, New York 19, N. Y.*

FLUORESCENT LAMPS, FIXTURES, SIGN TUBING, WIRING DEVICES; LIGHT BULBS; RADIO TUBES; TELEVISION PICTURE TUBES; ELECTRONIC PRODUCTS; ELECTRONIC TEST EQUIPMENT; PHOTOLAMPS; TELEVISION SETS





Sylvania *completely* guarantees every fluorescent fixture . . . including every lamp and part for an entire year. For full details see the Sylvania Lighting Contractor who displays this emblem.

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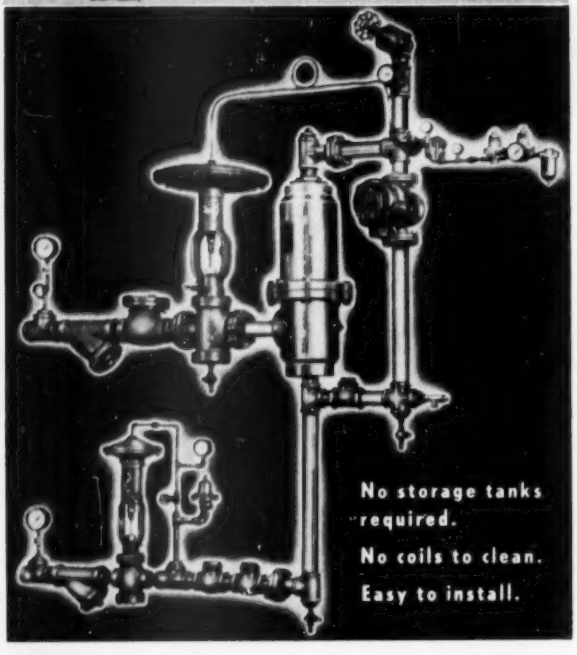
YOUR HOT WATER COSTS ARE TOO HIGH!



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Excessive Fuel Costs!
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Anxious to reduce operating costs? What about hot water — it's a big item? PICK Engineers are ready to help you save money on hot water required for any industrial need — processing, showers, washrooms, lab, truck washing, etc. PICK Heaters provide hot water INSTANTLY — by quiet steam injection. No waste of heat! They're entirely automatic to provide and accurately maintain temperatures up to 180° F. No storage tanks required. Easily installed in corners, on walls or overhead. Available in seven sizes with rated capacities of 10 to 300 gallons per minute at 140° F. temperature rise. Greater volumes can be obtained with multiple installations.

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Ford Motor Co.
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AND MANY OTHERS!

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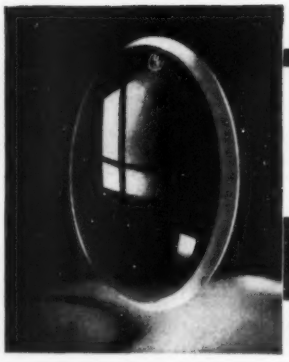

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Your choice of 3 Lens Materials

OPTILITE A—Recommended as your first choice because its extremely hard surface offers greater resistance to abrasion. Lightweight, great strength and fine optical qualities assure employee acceptance. Exceeds Federal Specifications for impact-resistance. Made of a special formula optical plastic.

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HARDENED SAFETY GLASS—For those who desire hardened safety glass we offer these lenses which are manufactured in strict accordance with Federal Specifications.

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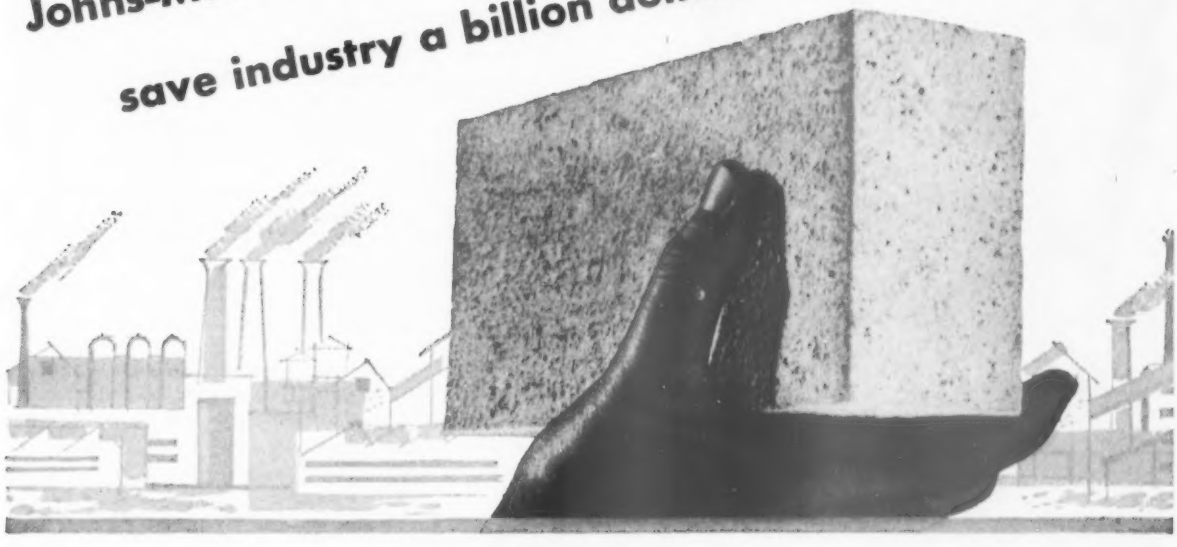
Johns-Manville Insulations save industry a billion dollars in fuel every year!



Reduce your fuel costs and build better furnace linings with JM-3000 INSULATING FIRE BRICK

HERE'S THE ONLY insulating fire brick that withstands a full 3000F. It's highly efficient both as an exposed refractory lining or as back-up insulation. And JM-3000 is only one of six types of Johns-Manville Insulating Fire Brick made for these applications. All provide long-life insulation. All are light in weight, have low conductivity, high structural strength. These properties permit thinner furnace walls—yet you can achieve important fuel savings and increased production, because J-M Insulating Fire Brick assures quick furnace response.

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Save fuel with J-M Hydraulic Setting Refractories

Johns-Manville refractories meet every need for castable, troweling and gunning applications for temperatures through 3000F. *Firecrete** is used to cast special shapes of all kinds. It is ready for use within 24 hours, has negligible shrinkage and high resistance to spalling. *Blazecrete** is used to build and repair furnace linings. When gunned, it adheres readily with a minimum of rebound loss. When slap-troweled, it eliminates laborious ramming and tamping.

Save Fuel with J-M Aggregates and Fills

These lightweight insulations are used as fills to conserve heat in irregular spaces where other forms of insulations cannot be economically applied. They are also used as aggregates for mixing with other materials to form insulating refractory concrete.

*Reg. U. S. Pat. Off.

Send for your free copy! This new booklet IN-115A gives full details about J-M insulating materials for service through 3000F. To find out how they can help cut your fuel costs, simply mail coupon.

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Johns-Manville FIRST IN INSULATION

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FM-3

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the shatterproof, weatherproof, translucent panel made of polyester resins, reinforced with a blanket of Fiberglas mat.

Greater Visual Comfort. Resolite diffuses daylight in all directions, eliminating the harsh contrast of sunshaft and shadow, present in conventional skylights and window glazing. Improvement in visual comfort means greater personnel efficiency, fewer accident hazards.

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The new Port Lavaca (Texas) plant of the Aluminum Company of America is amply daylighted with large areas of Resolite nested with Alcoa corrugated aluminum roofing and siding sheets.

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You should use Chicago "Safety Plus" Screws in Standard Listed Sizes.

They fasten products more securely, give a tighter hold for a neater appearance, and our three quarters of a century of experience in making fine threaded products guarantees a consistently more uniform accuracy to create sharper, smoother threads for a quicker, easier fit. They save money, too, because fewer screws and a faster fit means LOWER COSTS all down the line. Call the INDUSTRIAL SUPPLY DISTRIBUTOR nearest you today. Ask him for Chicago and get "Safety Plus".

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INCREASE production with CHELSEA INDUSTRIAL FANS

TYPE IND EXHAUST FAN
For factories, mills, theatres, schools, hotels etc. Features belt drive with ball bearing motor. Sizes from 24" to 72".

Write for Catalog No. 400 Complete data and specifications on fans and blowers for every industrial and commercial application—address Dept. U-3.

STEP-UP OUTPUT and quality of workmanship, reduce industrial accidents and employee fatigue with proper ventilating and cooling equipment. CHELSEA Fans remove excessive heat, fumes, dirt, dust and grit, also dead stale air. 30 models, in over 200 sizes, are available, and each fan or blower is especially engineered and tested for its recommended application. All ratings are certified by P.F.M.A. test methods to insure proper performance.

TYPE BB ALL PURPOSE EXHAUST FAN

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CHELSEA FAN & BLOWER CO., Inc.
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This Size . . . . ➧

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with all "kinds of sizes" in between

SKF's wide range of bearing types and sizes, plus helpful SKF engineering cooperation, makes it possible for you to select the bearing whose characteristics make it the best bearing choice for your particular application.

SELF-ALIGNING BALL BEARINGS

Compensate for angular misalignment resulting from faulty mounting, shaft deflection or distortion of the foundation. For radial loads and moderate thrust loads in either direction.

SPHERICAL ROLLER BEARINGS

Unexcelled for capacity. Inherently self-aligning. The full capacity of the bearing is always available for useful work. Will carry substantial thrust load in either direction.

DOUBLE-ROW DEEP GROOVE BALL BEARINGS

Embody the same design principle as the single-row type, but have lower axial displacement and substantial thrust capacity in either direction. Have very high radial capacity.

SINGLE-ROW DEEP GROOVE BALL BEARINGS

Sustain, in addition to radial load, substantial thrust load in either direction even at high speeds. Available with famous Fairprene Red Seals which keep dirt out and lubricant in. Also with any combination of Red Seals, shields, and snap-rings. Furnished in standard or precision tolerances.

ANGULAR CONTACT BALL BEARINGS

Support heavy thrust load in one direction, sometimes combined with moderate radial load. Can be mounted singly or in tandem for constant thrust load in one direction; also in pairs, face-to-face or back-to-back, for combined thrust and radial loads.

CYLINDRICAL ROLLER BEARINGS

Very high radial capacity and low friction which permits high-speed operation. Easy to dismount, even when both rings are mounted with a tight fit.

BALL THRUST BEARINGS

For pure thrust load in one direction only. Not self-aligning. The load line through the balls is parallel to the shaft axis, resulting in high thrust capacity and minimum axial deflection.

SPHERICAL ROLLER THRUST BEARINGS

For heavy thrust loads, or combined loads which are predominantly thrust, at high speeds on vertical or horizontal shafts. Fully self-aligning.

SKF®
BALL AND ROLLER BEARINGS

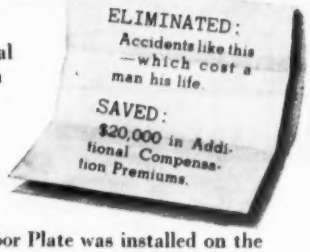
SKF INDUSTRIES, INC., PHILADELPHIA 32, PA.
– manufacturers of **SKF** *and* HESS-BRIGHT *bearings.*

2380

. . . THEN WE INSTALLED ALGRIP

And Ended Slipping Accidents And High Insurance Costs!

It happened at a large industrial plant, where oil and grease on a loading platform created a constant hazard. A lift truck skidded on the slippery surface, toppled from the platform's edge, and crushed the operator to death.



Then A.W. ALGRIP Abrasive Rolled Steel Floor Plate was installed on the platform—and slipping accidents ended at once. For ALGRIP is truly non-slip—even on steep inclines! Hundreds of tiny abrasive particles in each square foot of ALGRIP converted the slippery, dangerous platform into a hard gripping, anti-skid surface—safe for men and vehicles alike.

IMMEDIATE SAVINGS were obtained in three ways: (*1*) *No more costly, morale shattering accidents.* (*2*) *Faster handling of loads.* (*3*) *Workmen's compensation insurance premiums were substantially reduced by more than enough to pay for the* ALGRIP *installation.*

END SLIPPING ACCIDENTS THAT STEAL PRODUCTION AND KITE INSURANCE RATES

A.W. ALGRIP—only abrasive rolled steel floor plate in the world—pays for itself in savings from safety. Tough abrasive particles (same kind used in grinding wheels) put hundreds of tiny safety-brakes in every footstep—make it virtually impossible to slip even on steep inclines. ALGRIP doesn't wear smooth either—wear only exposes new particles. And tough rolled steel makes this floor plate stronger than other abrasive floorings. For safety at a saving, get the full ALGRIP story today. Write for our new Booklet AL-30—without obligation.

Over 125 Years of Iron and Steel Making Experience.

ALGRIP Abrasive Rolled Steel Floor Plate

ALAN WOOD STEEL COMPANY

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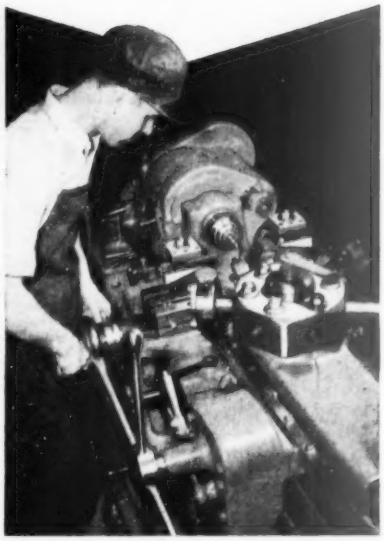
Other Products: A. W. SUPER-DIAMOND Floor Plate • Plates • Sheet • Strip (Alloy and Special Grades)

SOUTH BEND

2-H TURRET LATHES

for Exacting Operations



Accurate . . . fast . . . easy to handle, South Bend 2-H Precision Turret Lathes are highly efficient on second operations where tolerances and finishes are critical. Exceptionally wide ranges of power cross feeds, power longitudinal feeds, thread cutting feeds and power turret feeds provide maximum output for diversified jobs. *Write for Catalog 67-F.*

SPECIFICATIONS:

Collet Capacity—1". **Swing**—16¼". **Cross Slide Feeds**—48, .0006 to .0315". **Carriage Feeds**—48 R. H. or L. H., .0015 to .0814". **Thread Feeds**—48 R.H. or L.H., 4 to 224 per in. **Turret Feeds**—96, .0001 to .0148".

SOUTH BEND LATHE

SOUTH BEND 22, INDIANA

SOUTH BEND LATHES

GE Radio

CAN DO IT BETTER!

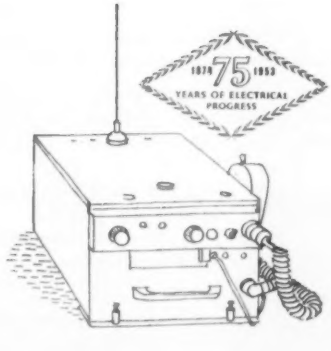
G-E 2-WAY RADIO gives instant contact—steps up production—increases profit!

IF your plant communications depends on signal flags or the fellow with the loudest voice, then present production rates and annual profit are not what they should be. *Large and small plant owners alike* who investigated and applied radio to their needs tell an amazing story. G-E industrial radio installations report: . . . "$51,000 saved in yearly overhead expenses" . . . "Increased truck utilization 100%!"

G-E 2-way radio will shave your operating costs radically . . . pay for itself quickly! Products can be stored or shipped faster. Handling equipment . . . trucks . . . personnel . . . all do more work in less time *and* with the top-flight supervision you've wanted.

Invite the G-E CAS* man to sit in at your next plant manager's conference. His expert advice will show you how to step-up production . . . increase profits! Call the local G-E office today or write: *General Electric Company, Section 6533, Electronics Park, Syracuse, N. Y.*

*Communications Advisory Service



You can put your confidence in—

GENERAL ELECTRIC

now! stop stoppage

in bins and hoppers with

. . . the only device that feeds stubborn materials uniformly and noiselessly from bins and hoppers by

positive displacement

PneuBin is a new but proven solution to the common, costly bin-flow problem. Neoprene panels, pulsating inside the bin walls, will feed the most difficult materials . . . from soap to salt, cork to coal, coarse lumps to micron fineness.

PneuBin moves the contents, not the bin . . . prevents arching and funneling, eliminates noise, saves bin repairs, permits closed tops. PneuBin succeeds where other devices fail.

Write for "Flow Stoppage Report" form . . . no obligation.

PneuBin is a product of **GEROTOR MAY CORPORATION,** Baltimore 3, Maryland . . . manufacturers of

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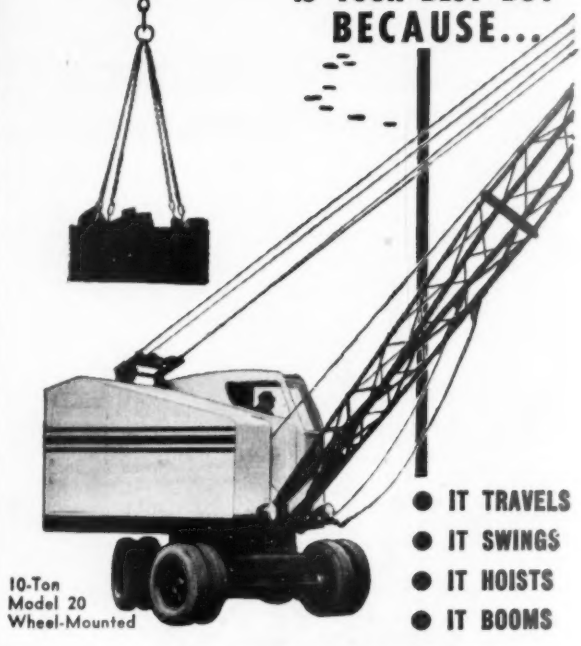
IF YOU WANT YOUR

YARD OPERATIONS

SPEEDED UP—

HEAVY-DUTY WAYNE CRANE IS YOUR BEST BUY BECAUSE...



10-Ton Model 20 Wheel-Mounted

- **IT TRAVELS**
- **IT SWINGS**
- **IT HOISTS**
- **IT BOOMS**

either SIMULTANEOUSLY or INDEPENDENTLY!

This means no stopping, clutching and shifting at each operation—saves time and excessive wear—results are more production, less costly downtime.

Wayne Crane Model 20 has three equal speeds forward and reverse—no turn-around problem.

A Wayne Crane dealer is located in every major industrial city. See him or write TODAY for specifications and prices. You'll like both!

WAYNE CRANE *Heavy-Duty* INDUSTRIAL CRANES 8 to 12½-ton capacity

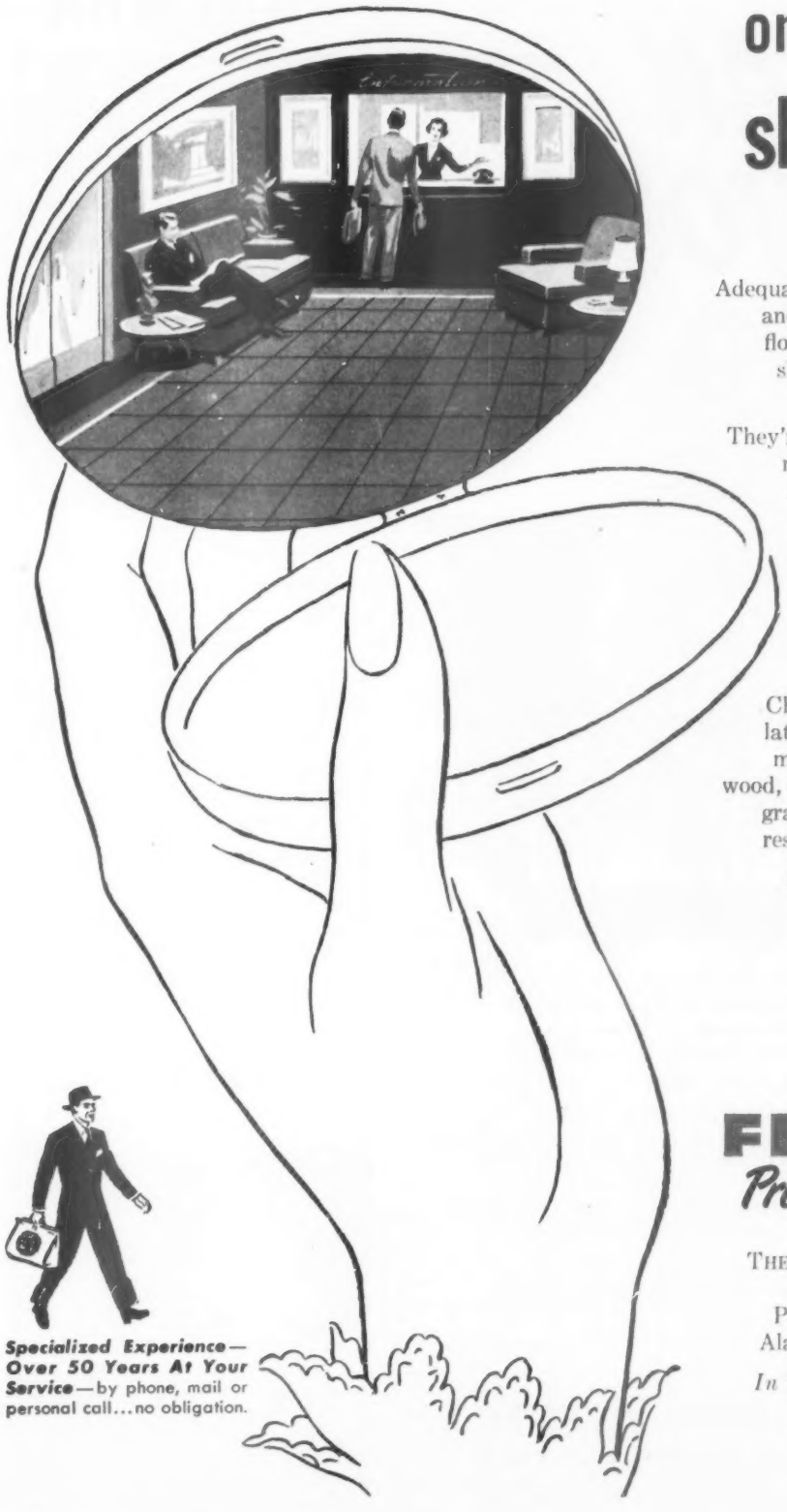
ALSO AVAILABLE

MODEL 40 12½-Ton Truck-Mounted

MODEL 66 8-Ton Crawler-Mounted

WAYNE CRANE DIVISION
AMERICAN STEEL DREDGE CO. INC.
FORT WAYNE 1, INDIANA

Is the **value** of your floors only skin deep?



Adequate *underlayments* give more worth and deeper value to your decorative floor covering . . . provide resilience, shock resistance, sound deadening, better endurance under traffic.

They're made by Flintkote. You simply mix and apply by trowel over any firm base in thin or thick section.

With Flintkote Mastic Underlayments you get a smooth, level base which is ideal for easy and economical tile installation . . . even over old, broken or patched floors.

Choose an asphalt emulsion, rubber latex or resin latex binder underlayment mix to suit the job. Is it over wood, steel or concrete? Above or below grade? Must it be lightweight, more resistant to oil, grease or chemicals?

Get the full story of lasting value in floors, including new uses of latex binder mastics for finished wearing surface. Write today.

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SAVE MAN HOURS!

HEIN-WERNER C-21 Push and Pull "Jackit"

Eliminate the need for crews, helpers, or complicated set-ups to handle heavy-duty bending, pressing, lifting, clamping, moving, and straightening operations. One man can do all these jobs faster, easier, and better when equipped with a Hein-Werner C-21 Push and Pull "JacKit".

The Hein-Werner C-21 includes a 20-ton "Push and Pull" Hydraulic Jack and 15 carefully selected attachments packed in a sturdy wooden chest. Jack pushes or pulls direct with one ram. You merely turn valve from right to left. Pump works at any angle . . . in any position. Remote control operation protects user. Varied attachments adapt jacks use to unlimited range of industrial applications.

Hein-Werner "JacKits" are available with "Push and Pull" Hydraulic Jacks of 4, 10, and 20 tons capacity complete in chest or rollaway metal stand. See your industrial supply distributor or write us.

Hein-Werner HYDRAULIC JACKS

HEIN-WERNER CORPORATION
WAUKESHA, WIS.

FOREMAN

ELECTRICAL, mechanical or industrial engineering background. Supervisory experience desired but not required.

THE company now in its 51st year is expanding rapidly. Net sales this year exceed 1938 by 16 times. Additional high caliber men are needed with training and experience in all phases of electronics, physics and mechanics.

Write us about yourself, if your experience and future plans fit into this picture.

JOHN WELD
Department D

SYLVANIA ELECTRIC PRODUCTS INC.
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For a list of reprints of some of FACTORY's best recent articles on a variety of subjects on

• Production •

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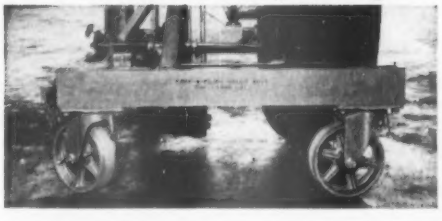
391

MATERIALS-HANDLING NEWS

★ Panel Discussions by Bassick, World's Largest Manufacturer of Casters and Floor Protection Equipment ★

Casters Equipped With These Conveniences Make Materials-Handling Easier, More Economical

Plunger-type Lock Prevents Swivel From Operating

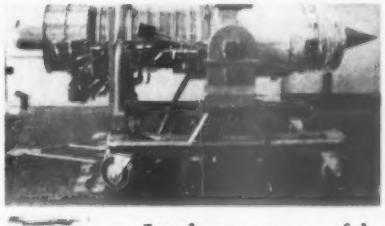


Sometimes it's desirable to keep a caster from swiveling. For such applications, there are many standard Bassick Casters which can be supplied with the easily operated plunger-type Swivel Lock. Complete flexibility in handling operations, for close quarters or long hauls.

Locking Is Sure With This Wheel Brake

In some kinds of materials-handling operations, a simple mechanism is needed to keep a wheel from turning. There's no substitute for the sure-holding action of Bassick's hand-operated Side Wing Brake.

Exclusive Sprung-Wheel "Floating-Hub" Absorbs Materials-Handling Shocks



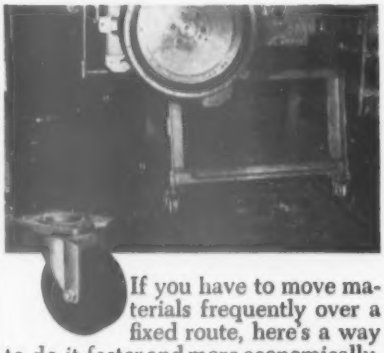
Loads are more safely and easily moved over rough surfaces when carried in equipment rolling on Bassick "Floating-Hub" Casters.

This patented construction actually "floats" a spring-controlled caster wheel in the frame, providing mechanical resiliency between rim and axle. Even over bumps, all wheels keep in contact with the floor. Hence, load distribution is always even. That's why Bassick's "Floating-Hub" means sure protection for highly-finished auto bumpers, ceramic products, glass and china ware, loose loads of small precision parts and innumerable fragile loads.

Hold Portable Equipment In Fixed Position With This Position Lock

Install Bassick Position Locks on portable equipment, and you can hold it in position with an easy, downward press of the lock's foot lever. This action places almost 12 sq. in. of friction locking surface in contact with the floor. A slight upward pressure under the lock's lever releases it.

Boost Materials-Handling Efficiency With Grooved Wheels on Angle Track



If you have to move materials frequently over a fixed route, here's a way to do it faster and more economically.

Equip trucks and dollies with Bassick Grooved-Wheel Casters and move them on inverted angle iron track. By doing so, you control movement along the route with production-line efficiency, and also make movement three times easier than flat wheels in direct contact with the floor.

Angle iron track is easily installed, inexpensive, self-cleaning. Bassick Grooved-Wheel Casters operate on the track or in direct contact with the floor.

They come in 4, 6, 8, 10 in. sizes, swivel or rigid.

Write for full details — no obligation

Write us for full data on any of the products discussed here, or information on any Bassick Caster. Bassick makes the world's largest line with the sizes and types for everything you wish to move easily, quietly, efficiently. Consult your local Bassick industrial distributor for expert advice, backed by our factory engineering assistance when needed.

THE BASSICK COMPANY
Bridgeport 2, Conn.
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A DIVISION OF
STEWART SW WARNER
MAKING MORE KINDS OF CASTERS . . . MAKING CASTERS DO MORE

SCALES CONTROL COSTS

Check your needs now!

Production-wise and cost-wise . . it makes good cost sense to be sure you have enough scales—and the right scales—throughout your plant today!

A scale survey by your nearby Toledo office will supply this information for you—without obligation. It will point out *proven ways* to solve your problems in weighing, checking, testing, counting, batching, force-measuring and other operations . . . with a modern Toledo! Learn how Printweigh can stop the losses that occur through human errors. It will pay you to get in touch with your Toledo office—in the phone book in 200 cities. Or write for bulletin 2020, a condensed catalog of modern Toledos. Toledo Scale Company, Toledo 1, Ohio.

SERVICE
Factory-Trained
200 Cities

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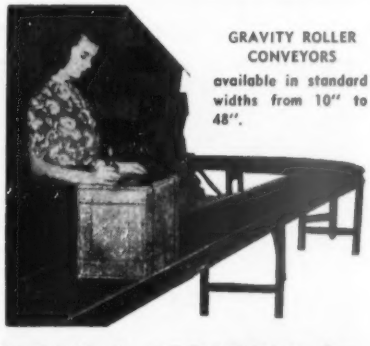
HEADQUARTERS FOR SCALES

"STREAMLINER"

SAVES TIME— MONEY — EFFORT

One way to reduce your handling costs, and at the same time speed the movement of your goods from receiving docks through processing, storage and shipping areas, is by way of Ferguson "Streamliner" Conveyors. Engineered to your plant and products, they'll help put more profits in your pocket. And they'll give you years of trouble-free service, too! Write for descriptive literature on our products.

GRAVITY WHEEL CONVEYOR
available in standard widths of 12", 15", 16", 18" and 24".



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available in standard widths from 10" to 48".

HARRY J. FERGUSON CO.

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YOUR
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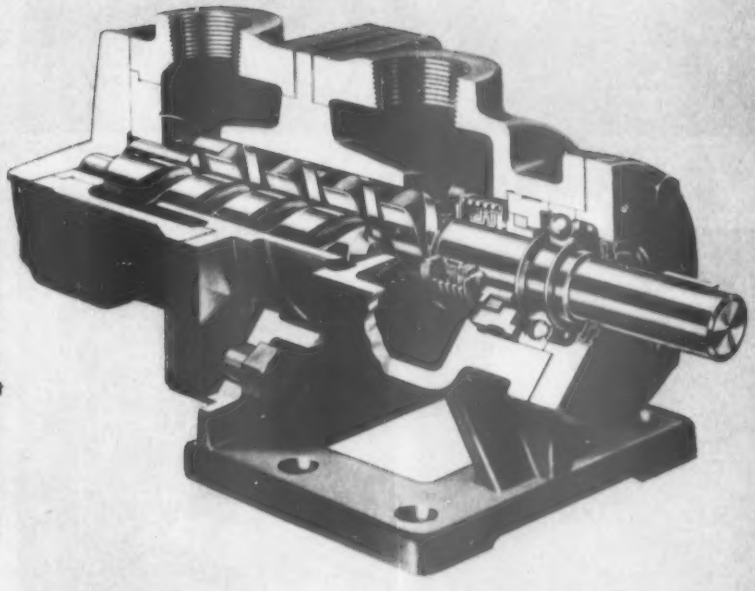
FIELD
REPRESENTATIVE

can help solve
your pumping problems

Profit by his sound, versatile experience. He can aid you in selecting the IMO Pump you need . . . give you facts and figures on performance . . . bring valuable judgment to bear on your specific fluid handling application.



For example, De Laval-IMO Series A313B Pump handles light or viscous fluids in hydraulic systems, rotary and steam atomizing oil burners, lubrication, governing systems and similar services. Use it for capacities to 80 gpm, pressures to 275 psi and intermittent pressures to 325 psi.

IMO Rotary Pumps have only 3 moving parts. There is nothing to get out of order, nothing to adjust. IMO Pumps are also easy to install. They can be direct-connected to electric motors, turbines or other high speed drivers, without reduction gearing, belts or chains.

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Models can be furnished for almost any fluid handling problem in capacities to 750 gpm and pressures to 1,500 psig. *Ask for Bulletin LG-A which gives data in chart form on the wide range IMO line.*

DE LAVAL *IMO Pumps*

DE LAVAL STEAM TURBINE COMPANY
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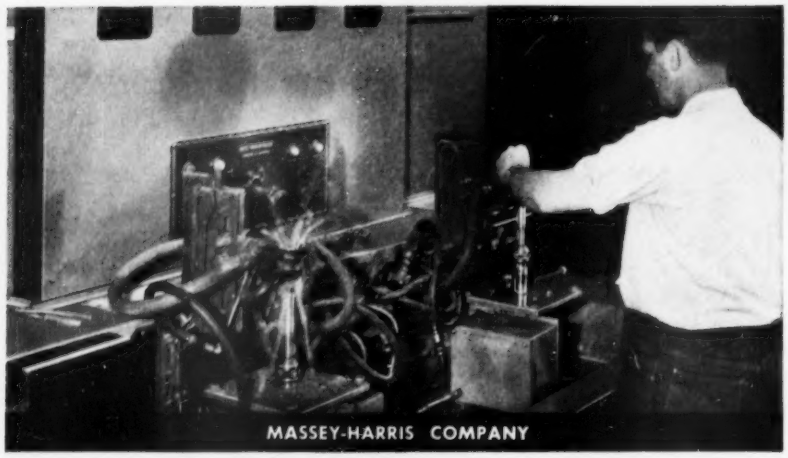
DL187

Industries



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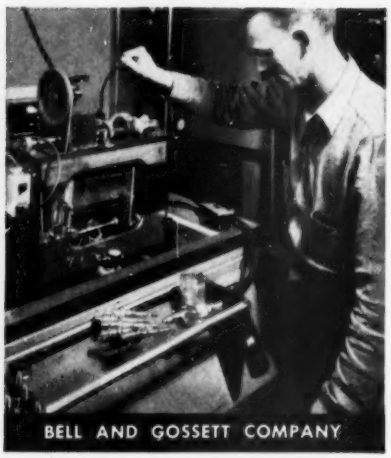

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Or a Compact Cabinet for Small Pieces

Pangborn Blast Cabinet—Saves time and money in cleaning small metal parts . . . removing rust, scale, grime, old paint, etc. Produces smooth, clean surfaces on pieces up to 60" x 35" in size. Models from . . . **$319** and up.

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Look to Pangborn for the latest developments in Blast Cleaning and Dust Control equipment.

Pangborn

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The Tremco Man—thoroughly trained and backed by a quarter century of roof experience—knows roofs and roof problems. His careful inspection of all critical areas—flashings, copings, parapets, etc.—enable him to stop major damage before it starts. He saves, rather than replaces roofs.

The Tremco Man's services include:

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(2) Recommendation of sound, labor-saving methods, and quality products.
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Now is the time to inspect roofs for winter damage. You may have the expert inspection and advice of your nearby Tremco Man without obligation. Write today for the 32 page booklet—"Solving Roof Problems."

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Substantial savings in time and labor resulted for the Scott Printing Machinery Works, Plainfield, New Jersey, through recommendations made by Tremco Man Harry S. Cline. Work of resaturating the dried out roof mat was done by the plant maintenance crew, instructed in Tremco's mechanized maintenance methods. Rental of the Tremco Roofing Pump, piping material from the ground to the point of application, saved time and money.

TREMCO

PRODUCTS AND METHODS FOR BUILDING MAINTENANCE

* The Tremco Man can also help you solve problems involving floors, sash maintenance, water repellence and interior and exterior painting.

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CROSS-SECTION *of Pittsburgh-developed feather-tip Neoceta bristle—showing molded in grooves for superior paint carrying capacity*

MISTER, the RED STRIPE on your brush is your assurance of quality! It means that the feel of the handle, the flex of the bristles make *any* painting job easier for you. It means that whether you choose Red Stripe's all-Neoceta brush or Red Stripe's combination of hogs' bristle and Neoceta, you're getting a brush that paints smoother, faster, better. Why? Because Neoceta, Pittsburgh's feather-tip wonder-bristle, is designed *especially* for painting. And, in hogs' bristle - Neoceta combinations, both bristles wear at the same rate—another reason for better performance and longer life. Next time you need a brush, ask your supplier to show you Red Stripe!

FREE—the story of Neoceta—its development, its amazing characteristics. Write to the address shown below for your free copy of this interesting booklet.

There's a Pittsburgh brush for every home and industrial use!

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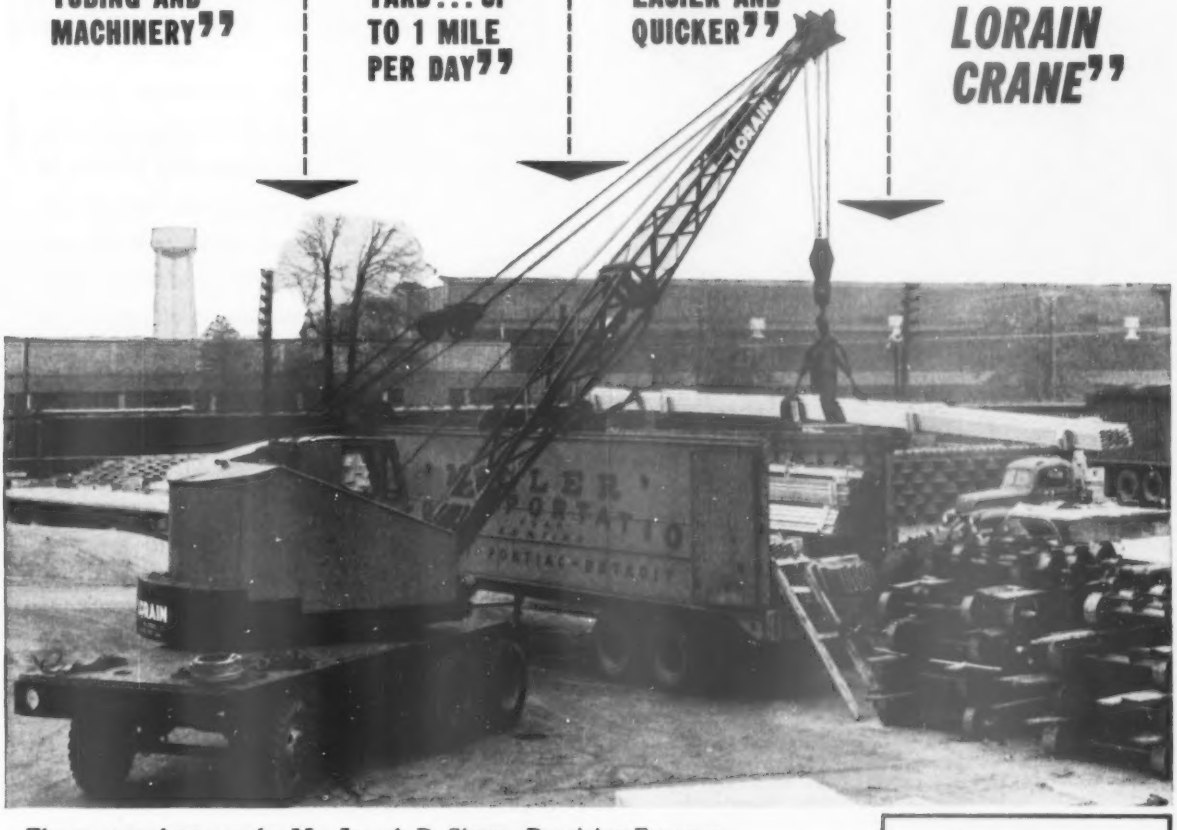
Saves time and dollars on material handling jobs

"UNLOADS STEEL, AXLES, ALUMINUM, TUBING AND MACHINERY"

"TRAVELS ALL OVER PLANT YARD... UP TO 1 MILE PER DAY"

"HANDLES LARGER BUNDLES, SAFER, EASIER AND QUICKER"

"NO LOST TIME WITH *LORAIN CRANE*"



The quotes above are by Mr. Joseph P. Simon, Receiving Foreman at Trailmobile, Inc., Cincinnati, Ohio. He's talking about the performance of their mobile 15-ton Lorain Self-Propelled Crane, Model SP-254. This well-known manufacturer of trucks and trailers has found these important time and money-saving advantages from the use of their rubber-tire Lorain.

The same advantages can be applied to your material handling problems . . . for these same reasons. Lorain Self-Propelled Cranes are one-man operated — one man does the work of a crew. They roll on big rubber tires at 7 m.p.h. anywhere you want to lift, load or carry. Air steering makes these mobile Lorains extremely maneuverable and easy to handle. Sixteen or more crane boom attachments permit handling any size, shape or type material. Long booms can stack high, reach far — save valuable yard space.

Lorain material handling cranes on rubber are available in capacities from 6 to 45 tons. Investigage the many advantages of the size to fit your plant. Your local Thew-Lorain Distributor can give you facts!

THE THEW SHOVEL CO., LORAIN, OHIO

See you at BOOTH 1325B

5th NATIONAL MATERIALS HANDLING EXPOSITION
MAY 18-22, 1953
PHILADELPHIA

THEW LORAIN
CRANES FOR INDUSTRY

BH POWERHOUSE CEMENT

in the bag this MORNING

reducing heat loss . . . upping output by NOON

That's how quickly and easily you can apply this finishing cement which also insulates. Pointing, sealing, applying and finish-trowelling can be done with a single coat and one scaffold setting. Applied over B-H Mono-Block or a refractory or firebrick, it provides effective permanent insulation—a smooth finish which takes both oil- and water-base paints.

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Please send complete information on

- ☐ POWERHOUSE CEMENT . . . High adhesion, black rockwool, insulating-finishing cement
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- ☐ NO. 1 INSULATING CEMENT . . . All-purpose, rust-inhibiting, plastic cement
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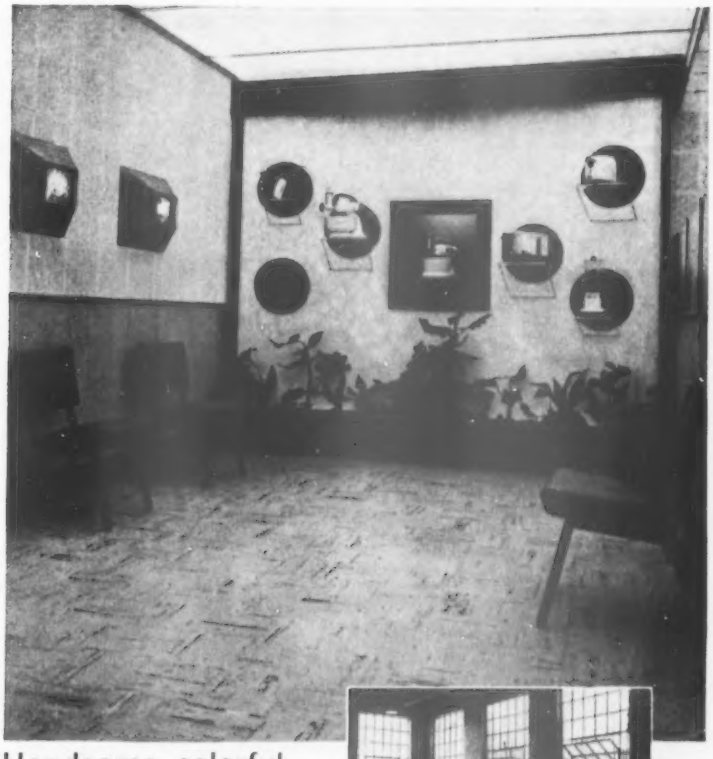
Classified Advertising Division

McGRAW-HILL PUBLISHING CO., Inc.
330 West 42nd Street New York 36, N. Y.

Bring Beauty and Toughness to Your Floors!



Handsome, colorful
FLEXACHROME*
for reception room
and offices

Rugged, greaseproof
TUFF-TEX* for
machine and heavy
traffic areas

When it comes to rich, warm, colorful flooring, you can't beat Flexachrome Vinyl Plastic-Asbestos Tile!

This beautiful, easy-to-clean, vinyl tile...offering an unlimited variety of patterns, is *perfect* for plant foyers, cafeterias, and general office space where appearance, wearability, and resistance to plant greases and oils are *musts*.

Use Flexachrome wherever bright color contrast or a high degree of light reflectancy is desired.

Tuff-Tex is made especially for industry. Use it in traffic areas . . . with built-in safety markers that can't wear off . . . for machine areas, plant kitchens, and cafeterias.

Tuff-Tex is greaseproof . . . fire resistant . . . impact resistant! Takes heavy truck traffic, floor vibration, the dropping of heavy boxes and tools. Cutting oils, lubricants and metal chips can't hurt it.

Both Flexachrome and Tuff-Tex are economical to install and maintain. Because of their smooth dense surface, waxing is not necessary unless a high gloss finish is desired.

Ask your Tile-Tex Contractor. He's in the classified pages of your telephone directory. Or, if you can't find him, write:

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When servicing costs are high as the lights...

LOWER BOTH LIGHTS AND COSTS WITH THOMPSON HANGERS

You're losing money when you use two men and a lift truck to service lighting fixtures . . . and you're risking someone's neck! THOMPSON disconnecting and lowering **HANGERS** facilitate rapid, safe, efficient floor-level maintenance of high-bay lights.

You can assure maximum round-the-clock lighting efficiency by following a planned maintenance program. And remember . . . *there is no faster, safer, or more economical means of servicing overhead lights than with THOMPSON HANGERS. Simple manual operation is exercised at floor level.*

1032 TE

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. . . and clipped pertinent ideas, articles and advertisements for reference, *please do not burn or throw it away.*

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OF INDUSTRIAL WORKERS
ARE VISUALLY UNQUALIFIED FOR THEIR JOBS

The record of visual performance tests of more than 5,000,000 individuals, in 4,000 job categories, reveals that, regularly, four of every ten industrial workers are visually unqualified for satisfactory performance on their jobs. It also shows just the degree to which these are the workers who are responsible for high costs . . . in accident rates . . . in waste and rejects . . . in labor turnover . . . in training time . . . in absenteeism.

YOU CAN IDENTIFY THE "VISUALLY UNQUALIFIED" IN YOUR PLANT

The Bausch & Lomb Occupational Vision Service is a scientific method for determining visual standards for every job, for identifying those who qualify, and for correlating visual skills to job requirements . . . to the profit of the employee and the employer.

A PROVED METHOD TO HELP YOUR PLANT MAKE MONEY 9 WAYS

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BAUSCH & LOMB CENTENNIAL

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1. Improved quality of production
2. Increased production per worker
3. Reduced waste of materials and work rejects
4. Improved accident record
5. Reduced labor turnover
6. Lowered training cost
7. More effective placement
8. Reduced absenteeism
9. Improved employee relations

MAIL TODAY!

Send for the brochure "Eyes Right for the Job," which tells what the Bausch & Lomb Occupational Vision Service is, how easily it can be administered in your plant, and at what low cost.

MORE PROFITS FOR YOU

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Please send me the brochure "Eyes Right for the Job," and complete details on the Bausch & Lomb Occupational Vision Service.

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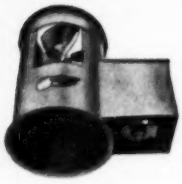

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Specially designed for applications handling corrosives and/or high-temperature air.

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ROCHESTER, MICHIGAN
Roof Ventilators for Every Commercial and Industrial Need

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Also increased earnings of employees, less absenteeism, and other gains.

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Index To Advertisements

This index is a service to readers. Every effort is made to maintain its accuracy, but FACTORY MANAGEMENT and MAINTENANCE assumes no responsibility for errors or omissions.

Acme Steel Company 245, 363
Adam Electric Co., Frank 53
Aget-Detroit Company 218
Air Express Div., Railway Express 48
Alan Wood Steel Company 374
Alemite Div., Stewart-Warner 155
Allen-Bradley Company Insert 176A, 176B
Allen Co., Inc., L. B. 218
Allen Ventilator Division, Production Planning Company 392
Allis-Chalmers Mfg. Co. 9, 20, 60, 275
Alsynite Company of America 218
Aluminum Company of America 353
Alvey-Ferguson Company 354
American Air Filter Company 203
American Airlines, Inc. 343
American Blower Corporation 302
American Bitumuls & Asphalt Co. 312
American Crayon Co. 348
American Optical Company 355
American Screw Company 21
American Smelting & Refining Co. 286, 287
American Wheelabrator & Equipment Corp. 328
Anaconda Wire & Cable Company 56
Anchor Fence Division Anchor Post Products, Inc. 360
Anderson Company, V. D. 174
Angier Corporation 283
Ansul Chemical Company 206, 244
Apex Machine & Tool Co. 347
Armour & Company 196
Aro Equipment Corporation 217
Atlantic Screw Works, Inc. 32
"Automatic" Sprinkler Corporation of America 330
Automatic Transportation Co. 15
Avco Manufacturing Corp. Lycoming Spencer Div. 315

Baker-Raulang Company 7
Baldwin-Hill Company 386
Barreled Sunlight Paint Co. 19
Bassick Company 379
Bausch & Lomb Optical Co. 389
Bay State Abrasive Products Co. 26, 27
Bearings & Motive Specialties Co. 348
Behr-Manning Corporation 40, 41
Belgian Electric Sales Corp 340
Benjamin Electric Mfg. Co. 323
Binks Manufacturing Company 348
Bituminous Coal Institute 16
Black & Decker Mfg. Co. 293
Blackhawk Mfg. Co. 222, 223
Blake & Johnson Co. 32
Blanchard Machine Co. 396
Bostitch, Inc. 200
Brighton Screw Mfg. Co. 213
Brown & Sharpe Mfg. Co. 233
Bruning Co., Inc., Charles 282
Buckeye Tools Corporation 264
Bulldog Electric Products Co. 303
Buschman Co., Inc., E. W. 358
Bussmann Mfg. Co. 24, 25
Butler Mfg. Co., Inc., B. B. 254

Cambridge Wire Cloth Co. 356
Carboloy, Department of General Electric Co. 166
Carey Mfg. Company, Philip 301
Century Electric Company 273
Chain Belt Company 33
Chelsea Fan & Blower Co, Inc. 372
Chester Hoist Division, National Screw & Mfg. Co. 168
Chicago Pneumatic Tool Co. 72
Chicago Screw Company 372
Chisholm-Moore Corporation 266
Clarage Fan Company 256
Clark Equipment Co., Industrial Truck Division 161, 292
Cleveland Cap Screw Company 252
Cleveland Crane & Engineering Co., Cleveland Tramrail Division 75
Cleveland Crane & Engineering Co., Machinery Division 74
Coffing Hoist Company 69
Continental Screw Co. 32
Cone Automatic Machine Co., Inc. 55
Cooper-Bessemer Corporation 295
Crane Company 17

Darnell Corporation, Ltd. 316
Day-Brite Lighting Co. 191
Dayton Rubber Company 224, 225
Dearborn Chemical Company 30, 31
De Laval Steam Turbine Co. 381
De Walt, Inc., Subsidiary of American Machine & Foundry Co. 77
Diamond Chain Company, Inc. 22
Doall Company 291
Dodge Mfg. Co. 342
Doepke Mfg. Co., Inc., Chas. Wm. 299
Dolge Co., C. B. 218
du Pont de Nemours & Co., Inc. Finishes Division Ins 48A
du Pont de Nemours & Co., Inc. Textile Fibers Division 304, 305
Dow Corning Corporation 157
Dracco Corporation 311
Dumore Company 210

Eagle Lock Company 32
Ediphone Division Thos. A. Edison, Inc. 171
Edison Storage Battery Div., Thos. A. Edison, Inc. 312
Elco Tool & Screw Corp. 32
Electric Controller & Mfg. Co. 308
Electric Storage Battery Co. 62, 63
Elliott Company Crocker-Wheeler Division 183
Elwell-Parker Electric Co. 13
Equipment Manufacturing Inc. 384
Equipto, Division of Aurora Equipment Company 206
Euclid Crane & Hoist Corp. 280

Factory Management & Maintenance 238, 239, 391
Fairbanks, Morse & Company 179
Ferguson Co., Harry J. 380
Finnell System, Inc. 227
Flexible Steel Lacing Co. 318
Flintkote Company 377
Foote Bros. Gear & Machine Corp. 307
Foster Company, L. B. 350

Gates Rubber Company 271
General Box Company 228
General Electric Co., Apparatus Dept. Insert 16A, 16B, 28, 29, 46, 47, 58, 59, 337
General Electric Co., Construction Materials Div. 359
General Electric Co., Lamp Dept. 351
General Electric Co. Electronic Tubes 240
General Electric Co. 2-Way Radio 375
Gerotor May Corporation 376
Goodrich Company, B. F. 1, 6
Goodyear Tire & Rubber Co. 10
Gould National Batteries, Inc. 195
Graybar Electric Company 5
Great Lakes Screw Corp. 32
Grinnell Company, Inc. 253
Gummed Products Company 336

Hansen Manufacturing Company 189
Hapman Conveyors, Inc. 272
Harnischfeger Corp. 172, 173, 248, 249
Harper Co., H. M. 32
Harrington Company 246
Haynes Products Co. 218
Hein-Werner Corporation 378
Hewitt-Robins, Inc. 38, 39
Honan-Crane Corporation 237
Hough Co., Frank G. 331
Houghton & Company, E. F. 366
Hudson Pulp & Paper Corp. 193
Hyatt Bearing Div., General Motors 159
Hyster Company 327

International Steel Company 242

Jefferson Electric Company 325
Jenkins Bros. 341
Jeffrey Mfg. Co. 235
Johns-Manville Corporation 349, 371
Johnson Bronze Company 352
Jones & Lamson Machine Co. 18
Jones & Laughlin Steel Corp. 201
Joy Manufacturing Co. 73

Kalman Floor Co., Inc. 350
Keasbey & Mattison Co. 279
Keller Tool Company 270
Kentile, Inc. 345
Kester Solder Company 296
Kex National Service 214

Keystone View Co. 392
Kidde & Co., Walter 339
Klein & Sons, Mathias 364
Klemp Metal Grating Corporation 167
Kling Bros. Engineering Works 175
Kold-Hold Mfg. Co. 310
Koppers Company 49
Korfund Company, Inc. 370

Lamson & Sessions Co. 78
Larson Products Corp. 188
LeBlond Machine Tool Co., R. K. 44, 45
Lewis-Shepard Company 187
Lincoln Electric Company 169
Lincoln Engineering Co. 220, 221
Link Belt Company 8, 57, 361
Logan Company 177
Lubriplate Div., Fiske Bros. Refining Co. 356
Lunkenheimer Corporation 81
Lyon Metal Products Co., Inc. 317

Magnesium Company of America 184
Mahon Company, R. C. 257
Manning, Maxwell & Moore, Inc. 180
Markem Machine Company 170
Marlow Pumps 176
Master Bronze Powder Co. 358
Master Electric Company 281
Mathews Conveyer Company 216
MB Manufacturing Co. 236
McCaskey Register Company 192
McGraw-Hill Book Company 366
Mechanical Handling Systems, Inc. 278
Micro-Switch Corporation 322
Milwaukee Electric Tool Corp. 202
Minneapolis-Honeywell Regulator Company—Industrial Division 367
Mississippi Glass Co. 76
Mobilift Corporation 346
Modine Manufacturing Co. Ins 48B
Monarch Rubber Company 12
Multi-Clean Products, Inc. 326
Mycalex Corporation of America 284

National Electric Products Corp. 389
National Screw & Mfg. Co. 32
Newcomb-Detroit 388
Niagara Blower Company 332
Nicholson File Company 219
Norton Company 243

Ohio Brass Company 199
Osborn Manufacturing Co. 4
Owens-Corning Fiberglas Corp. 365

Pangborn Corporation 290, 382
Parker Appliance Company 165
Parker-Kalon Corporation 32
Peerless Photo Products, Inc. 211
Peters-Dalton, Inc. 320
Pheoll Mfg. Co. 32
Photoswitch, Inc. 319
Pick Manufacturing Co. 370
Pioneer Rubber Company 358
Pittsburgh Corning Corp. 258, 259
Pittsburgh Plate Glass Co., Brush Div. 368, 384
Plymouth Rubber Company, Inc. 312
Portable Electric Tools, Inc. 197
Powell Pressed Steel Co. 181
Pure Oil Company 285

Quaker Rubber Corporation 334

Randolph Laboratories, Inc. 298
Ranney Method Water Supplies, Inc. 368
Ready-Power Company 362
Remington Rand, Inc. 2nd Cover, 151
Republic Rubber Division Lee Rubber & Tire Corporation 212
Resolite Corporation 372
Ridge Tool Company 190
Richards-Wilcox 54
Rockbestos Products Corporation 321
Rockford Screw Products Co. 32
Roeblings Sons Company, John A. 333
Rome Cable Company 70, 71
Roots-Connersville Blower Div., Dresser Industries, Inc. 251
Roper Corporation, Geo. D. 198
Russell, Burdsall & Ward Bolt & Nut Corporation 14
Rust-Oleum Corporation 255
Ryerson & Son, Inc., Joseph T. 80

Sealmaster Bearings, Div. of Stephens Adamson Mfg. Co. 50
Scott Paper Company 64
Scovell Mfg. Co. 32
Screw Research Assn. 32
Seamless Rubber Company 318
Scovill Mfg. Co. 32
Shakeproof, Inc. 32
Shepard Niles Crane & Hoist Corp. 338
Simonds Saw & Steel Co. 36, 37
SKF Industries, Inc. 373
Skil Corporation 42, 43
Skinner Co., M. B. 218
Sly Mfg. Co., W. W. 268
Snap-On Tools Corporation 164
Solar Sturges Mfg. Div., Pressed Steel Car Company, Inc. 288
South Bend Lathe Works 374
Southern Screw Co. 32
Southington Hardware & Mfg. Co. 32
Speed-Dri Corporation 204
Spencer Turbine Co. 350
Sperry Products Co. 352
Sperti-Faraday, Inc. 280
Square D Company 3rd Cover, 65
Standard Conveyor Company 364
Standard Oil of Indiana 207
Standard Pressed Steel Co. 68, 357
Sterling Bolt Co. 32
Stewart Iron Works Co., Inc. 292
Stronghold Screw Products, Inc. 32
Sun Oil Company 153
Sylvania Electric Products Co. 369, 378

Tech-Clamp, Inc. 218
TelAutograph Corporation 182
Templeton-Kenly & Co. 284
Tennant Co., G. H. 262, 263
Texas Company 82
Thermoid Company 209
Thew Shovel Co. 385
Thomas Flexible Coupling Co. 194
Thompson & Son Company, Henry G. 208
Thompson Electric Company 388
Tidewater Associated Oil Co. 335
Tile-Tex Div., Flintkote Co. 387
Timken Roller Bearing Company 4th Cover
Tokheim Oil Tank & Pump Co. 250
Toledo Scale Company 380
Tomkins-Johnson Company 230
Towmotor Corporation 23
Trane Company 324
Tremco Manufacturing Company 383
Trent Tube Company 277
Tropical Paint & Oil Company 186
Trumbull Dept., General Electric Company 229

Udylite Corporation 309
Union Oil Company 306
Unistrut Products Co. 247
U. S. Rubber Company 329
U. S. Rubber Company Electrical Wire & Cable Dept. 231
U. S. Safety Service Co. 370
U. S. Steel Company 265

Vacu-Blast Company 232
Valley Electric Corporation 354
Van Nostrand Company, Inc., D. 354
Veeder-Root, Inc. 11

Wagner Electric Company 267
Wayne Crane Div., American Steel Dredge Co., Inc. 376
Wayne Pump Company 79, 300
Webb Company, Jervis B. 269
Western Felt Works 344
Western Insulated Wire Co. 294
Westinghouse Electric Corp. 34, 35, 66, 67, 185, 260, 261, 297
Westinghouse Electric Corp. Electronics & X-Ray 234, 382
Westinghouse Electric Corp. Electronic Tube Div. 205
Westinghouse Electric Corp. Lamp Div. 274
Westinghouse Electric Corp. Sturtevant Div. 314
Wheeler Insulated Wire Co., Inc. 362
Wheeling Corrugating Co. 178
Willson Products Company 52
Wilshire Power Sweeper Co. 360
Wire Rope Sling Dept., American Chain & Cable Co. 241
Worthington Corporation 51

Yale & Towne Mfg. Co. 215

INDUSTRIAL CONSULTANTS 390

SEARCHLIGHT SECTION
(Classified Advertising)
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EMPLOYMENT
Positions Vacant 392, 393
Selling Opportunities Offered 392
Employment Agencies 392
Employment Services 392
Positions Wanted 393
Selling Opportunities Wanted 393
SPECIAL SERVICES 393
EQUIPMENT
(Used or Surplus New)
For Sale 393
WANTED
Equipment 393

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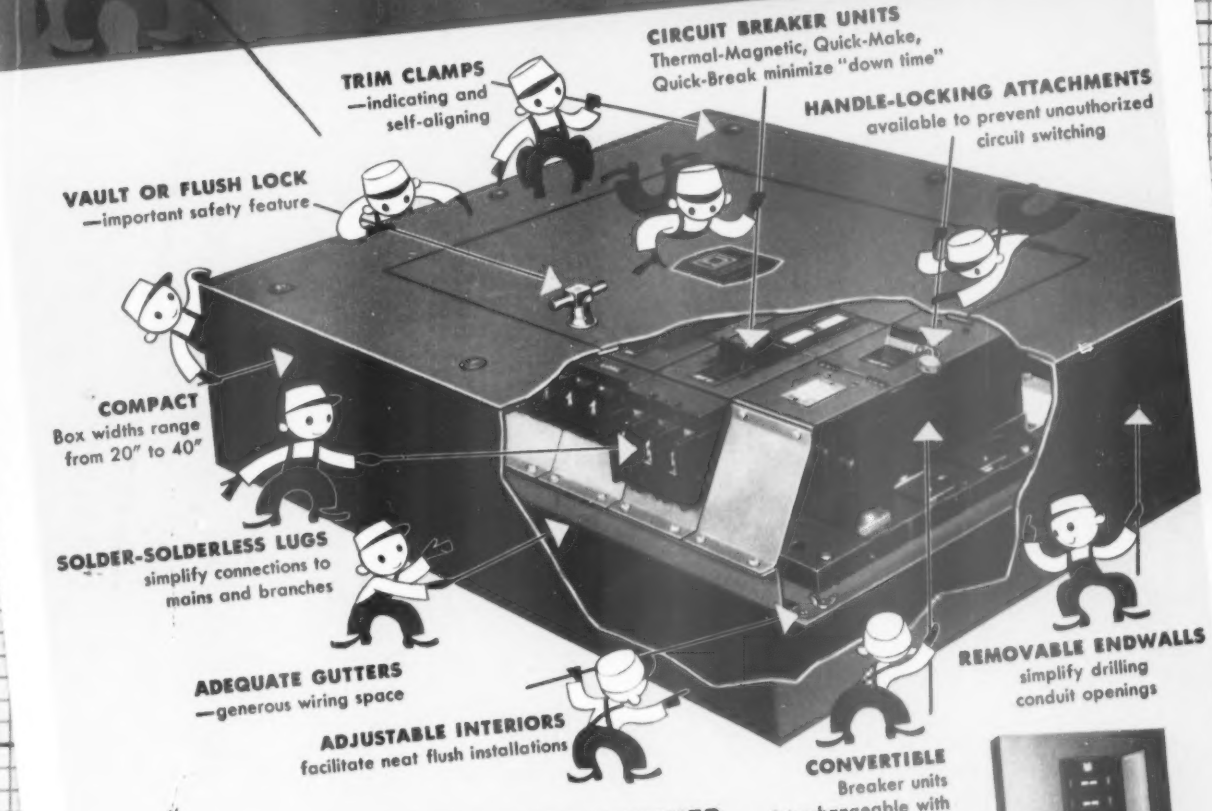

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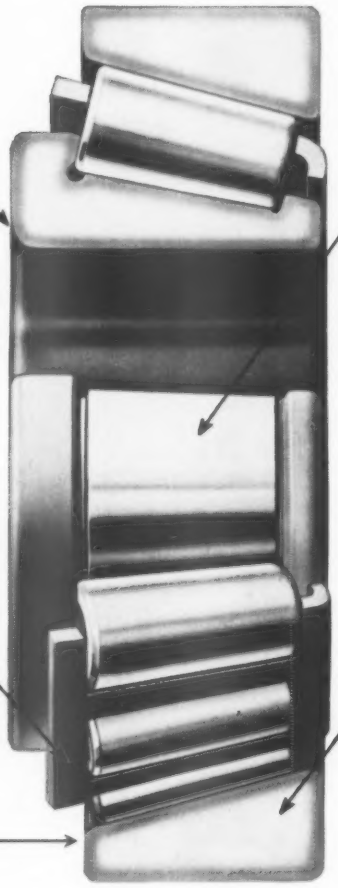

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